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ABSTRACT

This study addressed the problem of meeting the needs of elementary school gifted students in mainstream computer literacy instruction. The objectives of the study were to provide the teachers with a knowledge of Logo commands and concepts, and to help them develop a positive attitude toward the use of Logo. Twelve workshop sessions were held for a group of eight teachers. The teachers received instruction in the computer programming language, Logo, based on a study guide and sample programs. The guide contains theoretical background information about Logo, and related Logo activities that were designed to serve as a reference for developing additional activities. Teachers surveyed after the workshops indicated that they had adequate knowledge and materials to teach Logo. During the 3-week period after the workshop, all of the teachers used Logo activities at least once. These results indicate that the workshops, study guide, and sample programs provided the teachers with the confidence and ability to incorporate Logo into mainstream computer literacy instruction. Appendices contain the study guide, workshop lesson plans, program listings, and recommendations for workshop facilitators. (22 references) (Author/DB)

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**TEACHING ELEMENTARY SCHOOL
TEACHERS TO USE LOGO WITH GIFTED STUDENTS**

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by
JEANETTE CHRISTIE LIS

**A Practicum Report
submitted to the Faculty of the Center for the
Advancement of Education of Nova University in partial
fulfillment of the requirements for the degree of Master
of Science.**

June 1988

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Teaching Elementary School Teachers To Use Logo With Gifted Students.

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The author addressed the problem of meeting the needs of elementary school gifted students in the mainstream computer literacy instruction. The objectives of the practicum were to provide the teachers with a knowledge of Logo commands and concepts and to help the teachers develop a positive attitude toward the use of Logo. Twelve workshop sessions were held for the target group of eight teachers. The teachers received instruction in the computer programming language Logo. A study guide and sample programs, developed by this author, served as the basis for instruction. The guide contains theoretical background information about Logo plus related Logo activities. The activities were designed to be used in the workshops and also to serve as a reference for developing additional activities following the workshops. The concept of Logo as a philosophy of education and a "Logo environment" as an element of that philosophy was addressed in the delivery of the workshops. The delivery method incorporated teaching techniques described by Cron (1983) and Leron (1985). In a post-implementation survey, 100 percent of the teachers indicated that they had adequate knowledge and materials to teach Logo. Furthermore, 100 percent of the teachers in the target population used Logo activities at least once in the three week period following the workshops. These results indicated that the workshops, the study guide and the sample programs provided the teachers with the confidence and ability to incorporate Logo into the mainstream computer literacy instruction. (Appendices include the study guide, workshop lesson plans, program listings and recommendations for workshop facilitators.)

AUTHORSHIP STATEMENT

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my work, presented here will earn similar respect.

Jeanette Christie Lis

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Chapter I

Purpose

The setting for this practicum was a public elementary school in South Florida. Although the school was 30 years old, the facilities were well maintained. The physical plant included 24 classrooms, one portable building containing three classrooms, a library, a cafeteria and administrative offices. A dwindling enrollment allowed empty classrooms to be used for art, music, compensatory education, exceptional student education (ESE) and guidance. One classroom had been converted into a microcomputer lab and contained 15 Apple IIe computers. The staff included: a principal; 19 classroom teachers for Grades kindergarten through five; part-time teachers for art, music and physical education; a full-time media specialist; a primary specialist; a guidance-ESE specialist; a speech and language teacher; a varying exceptionalities teacher and a part-time teacher of the gifted who also served as a school-based computer resource teacher.

The author of this practicum served as both the computer resource teacher and the teacher of the gifted. As the computer resource teacher, this author was responsible for coordinating the school's computer literacy program. This included scheduling computer lab classes, advising the teachers in the instruction of the computer literacy curriculum, maintaining computer hardware and software and disseminating information regarding county computer policies and activities. The Elementary Computer Literacy Curriculum Guide, published by the county in which this author taught, outlined the program objectives and minimum basic skills for each grade level. Each class was scheduled for the school's computer lab for one-half hour per week. The classroom teacher was responsible for teaching the objectives and skills in the guide; this author was responsible for helping the teachers accomplish this.

As the teacher of the gifted, this author was responsible for teaching the gifted resource classes, writing an Individual Education Plan for each student in the program and conducting the required annual reviews and three-year re-evaluations. The 13 gifted students at the school where this author taught were clustered by

grade level and pulled from the mainstream classroom to participate in the gifted resource program. The six students in Grades one and two met three times a week for a total of five hours. The eight students in Grades four and five met five times a week for a total of seven and one-half hours. There were no students in Grade three who had been identified for the Gifted Program at the time this practicum took place. The Individual Educational Plan (I.E.P.) specified the teacher's general goals for each student and the number of hours per week the student was enrolled in the program. Each year an annual review was held to update the goals and review the student's progress. Every three years a re-evaluation was held to determine if the program was meeting the needs of the student.

The integration of computers into the Gifted Program was notably influenced by two major factors: this author's dual role as teacher of the gifted and computer resource teacher and the housing of the Gifted Program in the school's computer lab. While these factors fostered an environment where computers were used to a greater degree than in most gifted programs,

computers were not the nucleus of the Gifted Program. The specific topics chosen for individual or group study were based on the students' needs and interests plus the county's gifted curriculum guide. Computers were integrated into group and individual projects as a tool to facilitate student learning. The most frequently used software included Bank Street Writer, a word-processing program and Apple Logo, a programming language. The Print Shop, The Newsroom and educational games such as Where In The USA is Carmen San Diego?, Treasure Hunter and Snooper Troops were also popular with the students.

The grade level distribution of the 13 gifted students in this school influenced the decision to cluster grade levels for the gifted resource program. As a result, the gifted resource program required the use of the computer lab for a total of 12 hours per week. The computer literacy program required the use of the computer lab for a total of 10 hours per week. The total hours required by both programs were 22 hours, and the instructional week was based on 27 and one-half hours. This allowed a non-conflicting schedule for both programs.

As previously mentioned, the classroom teacher was responsible for teaching the computer curriculum. The following statement spoke directly to a problem that existed at the school where this author taught. "Teachers cannot effectively teach what they do not feel confident about themselves" (Combs 1985, p.3). The classroom teachers could not adequately meet the gifted students' needs in the mainstream computer literacy instruction, because the classroom teachers lacked the knowledge, confidence and materials to implement the computer programming language Logo into the computer curriculum. This practicum proposed to eliminate the gap between the classroom teachers' lack of knowledge of Logo and the gifted students' need to use Logo in the regular computer education program.

The author of this practicum surveyed the teachers in Grades one through five. Kindergarten and pre-first teachers were not included in the survey, because students were not identified for the Gifted Program before first grade. The answers to questions number four and five on the Survey of Gifted (Appendix A:56) showed that 53 percent of the teachers would not allow or even encourage the gifted students to use Logo. The

only grade where all of the teachers at the grade level reported using Logo was first grade. When these first grade teachers were eliminated from the survey, the percentage was raised significantly to 73 percent. The 53 percent represented 8 out of 15 teachers, while the 73 percent represented 8 out of 11 teachers. The classroom teachers' reluctance to allow the use of Logo put the gifted students at a disadvantage. These students were prevented from using Logo in the computer classes taught by the classroom teacher.

In the county where this author taught, the Logo programming language was not a requirement of either the Gifted Program or the regular computer education program. It was, however, used in the Gifted Program as a tool for the students to "gain control over the learning process by teaching the computer, rather than being taught by it. Logo provides an environment where the computer becomes a tool to facilitate learning" (Bailey, Brautigam and Doran 1984, p. ix). Through Logo, the gifted students can further develop critical-thinking skills, problem-solving strategies and logical reasoning abilities. The discovery-oriented approach of Logo provides younger gifted students with

the means to explore sophisticated mathematical concepts.

Although the gifted students had access to computers and had been exposed to Logo during their gifted resource time, the responsibility of teaching the computer literacy curriculum fell on the classroom teacher. Prior to the implementation of this practicum, computer inservice and training for the classroom teacher focused on instruction in the minimum computer literacy skills, with little or no instruction in Logo. The gifted students came into the mainstream classroom with skills that were far beyond the minimum skills of the computer curriculum. For the gifted students to derive the full benefits of computer use and for their skills to be maintained and extended, the classroom teachers needed to be knowledgeable in the use of Logo.

While the gifted resource program served to meet the needs of the gifted students, those needs did not cease when the students returned to the mainstream classroom. A successful gifted program provides the avenue for skills learned in the resource program to carry-over and be useful in the mainstream classroom.

These statements were supported in a letter from the gifted curriculum supervisor (Appendix B:57).

The letter from the South Area Computer Curriculum Specialist in the county where this author taught suggested that the problem of integrating Logo was not unique to this school. This letter also stressed the value of providing classroom teachers with the knowledge and means to incorporate Logo into the curriculum (Appendix C:58). "The danger is that Logo will become the responsibility of the computer teachers, a delegated responsibility that relieves the other teachers of having to think about what Logo might mean in their classes" (Barclay, Martin and Riordon, 1985, p. 22).

The responses to the Survey of Logo Use (Appendix D:59) showed that while 47 percent of the teachers used Logo/E-Z Logo with their students, 80 percent indicated a lack of adequate knowledge of Logo. Furthermore, 100 percent indicated that a lack of adequate materials and ideas deterred them from teaching Logo. This writer believed these results were due to several underlying factors. When computers and the Elementary Computer Literacy Curriculum Guide were introduced, teacher training and inservice focused on teaching minimum

skills, because many teachers had little or no background knowledge to rely upon. Primary grade teachers had fewer skills to learn and found the task relatively easy. On the other hand, upper grade teachers, who were faced with a spiraling curriculum, found the task more difficult. In order to teach the skills at their grade level, the upper grade teachers needed to teach background skills that would normally be taught in the lower grades. Since they had more to teach, these teachers also had more to learn. As a result, the burden of acquiring the minimum literacy skills, coupled with a full teaching load, left teachers with neither the time nor the motivation to explore applications such as Logo.

The answers to the Survey of Logo Use (Appendix D:59) showed that 53 percent were not aware of the lessons in the curriculum guide that use Logo/E-Z Logo, and 87 percent did not use these lessons. Examination of the Elementary Computer Literacy Curriculum Guide (1986) showed eight lessons using E-Z Logo and eight lessons using Apple Logo. The distribution of these lessons is shown in table 1.

Table 1
Distribution and Percentage of Lessons Using Logo

	Total Lessons	Lessons Using Logo	Percent Using Logo
Pre-First	23	6	26%
First Grade	28	1	4%
Second Grade	36	1	3%
Third Grade	27	3	11%
Fourth Grade	29	2	7%
Fifth Grade	20	3	15%

Analysis of the ten lessons using Logo/E-Z Logo at Grades one through five revealed that the skills being taught in seven out of ten lessons could also be taught using other software. Material to help the classroom teacher teach Logo consists of one page containing Logo Hints, reference to MECC's Apple Logo in the Classroom guide and worksheets for certain lessons that use Logo.

The introduction to the Elementary Computer Literacy Curriculum Guide (1986) states, "The emphasis is on computer literacy and awareness." It later states, "By integrating the use of microcomputers into all areas of the curriculum, the students are provided with not only a different medium of learning but also with computer literacy skills that are and will be necessary life skills" (p.I.1). These statements clearly indicated that, although the integration of computers into all areas of the curriculum is a desirable goal, the specific purpose of the guide is not to teach Logo but to provide literacy and awareness.

At the school/county level, there were very little Logo curriculum materials for elementary teachers. While there was a middle school guide for teaching Logo, it did not meet the needs of the elementary teacher who was reluctant to teach Logo. This practicum writer reviewed commercially produced materials that were available through the district's professional library. While these materials could have served as a valuable resource, they stressed the syntax of the Logo language and did not provide adequate background in the methods of teaching Logo. These materials alone did not meet the needs of this practicum.

The goal of this practicum was to provide teachers with the knowledge and confidence to teach Logo as a part of the regular computer curriculum. The specific objectives of the practicum were:

1. By the end of the implementation period, 100 percent of the participants would demonstrate the ability to use 17 out of 24 Logo commands/concepts. This would be demonstrated by the participants' ability to develop a procedure that produced a picture.

2. By the end of the implementation period, the participants would demonstrate a positive attitude regarding the use of Logo as evidenced by a 50 percent increase in affirmative responses to questions 5, 6 and 7 on the Survey of Logo Use (Appendix D:59) and questions 3 and 4 on the Survey of Gifted (Appendix A:56) administered before and after implementation.

3. Over a period of three weeks following implementation, at least one teacher per grade level would initiate plans to use Logo activities in the classroom or computer lab. This would be documented by inspection of a software sign-up sheet posted in the computer lab (Appendix E:61) and inspection of a software sign-out sheet for software that left the lab (Appendix F:63).

Chapter II

Research and Solution Strategy

Logo is a computer programming language that was developed in the early 1970's by Dr. Seymour Papert and his colleagues at the Massachusetts Institute of Technology. The successful integration of Logo depends upon cognizance of it as an effective teaching tool. Logo was developed as a tool for children to "gain control over the learning process by teaching the computer, rather than being taught by it. Logo provides an environment where the computer becomes a tool to facilitate learning" (Bailey, Brautigam and Doran 1984, p. ix). For the gifted student, the computer can be a valuable tool or a boring machine depending on how it is used. Torrence, as cited by Jensen and Wedman (1983), advocated using computers for simulations and problem-solving activities to evoke right-brain and whole-brain functions. Jensen and Wedman reiterated the idea of children controlling the computer rather than the computer controlling the children when they suggested that computer programming provided gifted students with a means of using this technology as well

as a situation that facilitates creative thinking, problem-solving and self-awareness (of personal capabilities and limitations).

Torgerson (1985) found that a search of the ERIC database revealed only 10 entries when the descriptors "Gifted", "Computers", "Primary/Elementary Education/Intermediate" were used. The author of this practicum searched the San Mateo Educational Resource Center (SMERC) and found only three entries when the descriptors "Logo" and "Elementary Gifted" were used. Two of these entries were final reports of the same project. No journal articles were pertinent. It appeared that computers and Logo were not being integrated into gifted programs in the elementary schools. Torgerson (1985) stated that this poor integration was caused by a lack of access to computers and teachers' inability to keep up with rapidly developing educational applications of the computer. As a solution, Torgerson suggested the collaboration of the computer lab director and the teacher of the gifted to plan and implement an effective program. Clearly, Torgerson's suggestion was being carried out in the author's school, because the author of this practicum

functioned as both the teacher of the gifted and the computer lab director. However, this did not solve the problem of a transfer of skills into the mainstream classroom. A viable solution would be to take Torgerson's suggestion one step further and include a collaboration between this practicum writer and the regular classroom teacher.

A search of the literature revealed many reasons for using Logo, although these reasons were not often supported by actual research. "Papert (1980) has proposed that the major benefits of Logo are that: (a) it provides powerful experiential learning (in the Piagetian sense) and (b) it enhances learning and problem solving ability" (Delcos, Littlefield and Bransford, 1985, p. 154). Harvey (1982) suggested that Logo is a language for learning in general, designed not for a specific purpose but as a means of exploring problem-solving behavior. Harvey (1982) and Upitis (1982) both agreed with Papert that Logo is a language with no threshold and no ceiling. It is simple enough for children to learn but has the capacity to illustrate complex mathematical ideas. Bull (1982) characterized

Logo as "interactive, procedural and extensible" (p. 62).

Molly Watt (1982) listed what Logo students said they learned from Logo. The partial list includes:

about problem-solving and estimation, about thinking and ... how to use their own learning style, to think logically, to use procedural thinking, to use strategies for problem solving, to become comfortable thinking mathematically and to take risks in learning. The most significant things they learn include: looking at their own mistakes with an interest in understanding what happened instead of with shame and understanding that learning and doing involve frustration and ease ... this is what makes up all work and life. (pp. 128-129)

Support for using Logo with young children was found in a study conducted by Powers (1985) where pre-schoolers showed improved scores on the Gesell Pre-School Test after being exposed to Logo. The study implied that children other than pre-schoolers could also benefit from Logo. The author of this practicum concurred with Powers' recommendation to incorporate Logo into the curriculum. The Brookline Project also showed many possibilities for the use of Logo; however, the teacher in the study was an elementary teacher with a doctorate in engineering. A teacher with a modest

amount of training and experience would have difficulty implementing these findings (Moursund, 1983-84).

While Logo advocates declared the advantages of the language, major research findings failed to support their claims. Two major research projects were the Haifa Project, conducted at the University of Haifa in Israel and the Bank Street College Project, conducted at Bank Street College in New York. Both projects used a non-directed, discovery-based method to teach Logo. Both found similar, confuting results. Children did not progress past the initial levels of Logo and, therefore, failed to grasp the "powerful ideas" encompassed in Logo. There was no significant increase in problem-solving skills. When writing programs, the students did not use planning and debugging skills as expected (Cron, 1983). These results leave educators hard-pressed for concrete evidence to justify Logo's effectiveness as a learning tool. Literature revealed several other recurrent themes that also hinder the successful integration of Logo into the curriculum. Moursund (1983-84) cited unrealistic expectations of the language and insufficient research to uphold its effectiveness; while Watt (1982) cited lack of proof of

Logo's effectiveness in school settings and confusion concerning the theory of teaching/learning Logo. Moursund and Watt both cited a lack of adequately trained teachers and insufficient curriculum materials as problems.

In searching for effective ways to integrate computers into the curriculum, many educators have latched onto Logo as the panacea for all their problems. Upitis (1982) stated:

one of the dangers is in overextending the use of a Logo approach beyond the microworlds to which it is best applied. Not only should Logo be chosen for appropriate types of teaching/learning situations, but consideration should also be given to whether the same kind of learning may occur in another way, not requiring the assistance Logo offers. (p. 31)

Moursund (1983-84) stated that Logo can aid students in achieving such goals as learning to write and debug programs, developing an insight into top-down analysis of programming or studying a specific content through the discovery approach. Until educators understand the appropriate situations for using Logo, they will continue to make unrealistic demands on it. These demands could lead to the rejection of a viable learning tool.

While Logo advocates declared the advantages of the language, research findings did not support those claims, creating confusion as to how to approach the teaching of Logo. When Seymour Papert developed Logo as a tool for children to "learn how to think", he envisioned a discovery-based, child-directed environment. "The Logo teacher only intervenes when appropriate by slipping in 'powerful ideas,' not forcing or pulling the student along an already preconceived route" (Cron, 1983, p.62). Following this notion, many teachers back off from teaching Logo and expect these "powerful ideas" to just happen. When they don't, confusion and frustration results. Leron (1985) stated that with a total Piagetian approach children do not grasp the "powerful ideas" as well as we expect; while pushing these ideas too much puts us back to a didactic teacher-oriented teaching. Leron suggested a modified version of Papert's method that is termed "quasi-Piagetian learning". In this method, the teacher assumes a more active role but maintains the exploratory, non-judgemental aspects of Piaget. Leron also added that this method should not be misconstrued as a fixed or final method. Teachers should use it as a

basis for developing their own individual, personal style. Cron (1983) suggested "Guided Discovery" as a more structured version of Papert's method. In this method, the teacher presents a lesson and guides the students through activities that are designed to reinforce the lesson. At this point the teacher's role is not only to guide the students' thinking but also to encourage the sharing and collaboration of ideas. Later, when the children are working at the computer, the teacher encourages a discovery-based environment. Astute observation, socratic questioning and appropriate timing are crucial factors in maintaining the "Logo environment".

With this method in mind, we look at the way children "learn" Logo. Leron (1985) suggested that Papert's "powerful ideas" were more sophisticated and harder to achieve than first expected. He separated children's learning into three distinct levels: syntactical, semantic and expert. In the syntactical level, the child simply learned the rules of Logo. In the semantic level, the child developed the ability to actually use the rules that were learned. In the third and most difficult level, the expert level, the child

used the tools spontaneously and willingly. This writer concurred with Leron (1985) that the development of a

... well-planned, modular, spiral course extending over perhaps several years (so that there is plenty of time for children to experiment and grow naturally), accompanied by well-written, imaginative learning materials ... (p. 32)

was one of the most urgent tasks facing the Logo community.

Billstein (1982), Cron (1983), Leron (1985), Watt (1982) and others spoke of Logo as a philosophy of education and a "Logo environment" as an element of that philosophy. The effective use of Logo requires trained teachers and supportive curriculum materials. Teacher training focused on learning the Logo language but neglected one of the most important facets of implementing Logo - the environment or method by which it was taught (Riordon 1982). An effective Logo environment requires that the teacher maintain a balance of three key elements: teacher-directed lessons, group problem-solving discussions and student planned activities (Clements 1983-84).

Research suggested that an appropriate solution strategy should include teacher training that focuses on

a knowledge of Logo and the "powerful ideas" it encompasses plus an understanding of how to create a "Logo environment". Leron (1985) suggested that a study guide would allow students to work independently and allow the teacher to

... concentrate on helping the students reflect on and verbalize their computer experiences rather than actually carry them through these experiences. (p. 28)

Davis, Helms, Norman and Ponte (1984) recommended using discovery-learning techniques when teaching teachers, encouraging teachers to generate ideas for student projects and providing an abundance of examples and possible applications.

Punahou School in Honolulu, Hawaii began developing a program in 1982 to integrate Logo into the K-4 curriculum. The school's main objective was to use Logo to its best advantage without sacrificing any other subject in an already overcrowded curriculum. After implementing an intensive program for teachers and students to become familiar with Logo's capabilities, Principal Duane Yee and supervisors Elaine Blitman and Barbara Jamile noticed that teachers began linking Logo with their own curriculum. They predicted that as

teachers became more comfortable with Logo, they would become aware of more objectives that Logo would reinforce and thus devise more activities to support the curriculum (Lough 1983).

Riordon (1982) stated that Logo inventors feared that a published scope and sequence would lead to accountability and evaluation of student learning. He further stated that "Logo was not meant to be taught, and the kind of learning that occurs was not meant to be evaluated like other school learning" (p. 49). This practicum author believes that most teachers need an informal scope and sequence in order to feel confident to begin integrating Logo. This scope and sequence should be presented as a flexible guideline and include examples as well as suggested applications. As teachers gain experience with Logo, they will adapt the sequence to meet their needs.

Bull and Tipps (1983-84) declared that there was a need to develop classroom activities that explore and develop concepts in subject areas "as alternatives to traditional didactic teaching styles" (p. 57). They further stated that it was a challenge to the Logo

community to develop and share these activities rather than the responsibility of the individual teacher.

In the Survey of Logo Use (Appendix D:59), 80 percent of the teachers indicated that they did not know enough about Logo to implement it into the computer curriculum. This practicum attempted to educate the teachers in the Logo programming language and increase their confidence, so they would be able to meet the needs of gifted students. This would help the gifted students to carry their Logo knowledge into the mainstream computer classes and receive the needed support from the classroom teacher. Because 73 percent of the teachers who were surveyed indicated a willingness to attend school-based workshops on Logo, the author's solution strategy consisted of the design and delivery of these workshops. Because the problem in this practicum was directly related to students in the Gifted Program, the target population was those teachers in Grades one through five who volunteered to attend the workshops. The computer lab at the school where this author taught was equipped with sufficient hardware and software to conduct these workshops. The principal of the school gave this author permission to conduct the

workshops and to use the school's computer lab and software (Appendix G:64).

The first phase of the workshop used MECC's E-Z Logo to develop a fundamental knowledge of Logo. Familiarity with E-Z Logo served two purposes. It allowed teachers an insight into the background their students already possessed; and it provided an alternative for students who may not have been ready for the transition to Apple Logo. The second phase of the workshop focused on making the transition from E-Z Logo to Apple Logo by stressing the similarities between the two programs, the teachers were able to use their prior knowledge of E-Z Logo to understand Apple Logo. This step also provided teachers with the knowledge, skills and confidence to encourage this transition with their own students. The third and final phase of the workshop focused on the application of Logo skills. The teachers were encouraged to use Logo to teach the skills in the computer curriculum. These three workshop phases were based on the syntactical, semantic and expert learning levels described by Leron (1985). The author of this practicum believed that these learning levels relate not to the teachers' actual programming skills but rather to

their ability and willingness to incorporate the Logo programming language into the computer curriculum. The progression from E-Z Logo to Apple Logo was chosen because it paralleled a progression that teachers could use with their students.

Throughout the workshops, this author tried to create an effective Logo environment by incorporating the "Guided Discovery and "quasi-Piagetian" methods described by Cron (1983) and Leron (1985). Riordon (1982) pointed out that the "Logo environment" is often neglected in teacher training. The importance of creating this effective Logo environment with teachers was supported by Davis, Helms, Norman and Ponte (1984). A study guide containing sample programs, helpful hints, project ideas and suggested applications was incorporated into the workshops (see Appendix H:65). The purpose of the study guide was two-fold. During the workshops, the participants used the study guide to work independently. This allowed the workshop facilitator (this practicum author) to demonstrate the use of discovery-learning techniques. This idea was based on the suggestions of Leron (1985) and Davis, Helms, Norman and Ponte (1984). After the workshops, the study guide

would serve as a reference manual for teachers to use when they implemented Logo with their students. The organization of the material in the guide served as the informal scope and sequence suggested by the author of this practicum. The inclusion of project ideas and suggested applications was supported by Bull and Tipps (1983-84) and Davis, Helms, Norman and Ponte (1984). Teachers were encouraged to create a journal or notebook in which additional notes and ideas were recorded. The entire process attempted to serve as a model for the teachers to use when they themselves implemented Logo with their students.

Chapter III

Methodology

Implementation of this practicum took ten weeks. During weeks one through four, the author of this practicum wrote sample Logo computer programs and documentation. (See Appendix I:66). The author also developed a related study guide (Appendix H:65) that includes materials and ideas for expanding and integrating Logo concepts into the curriculum. During weeks five through ten, the author of this practicum conducted workshops for the target population of eight first grade through fifth grade teachers. The computer programs (Appendix I:66) and study guide (Appendix H:65) were an integral part of those workshops. The hardware and software necessary to conduct the workshops were available at the school where this author taught. The workshops were one hour in length and were conducted twice weekly. The author of this practicum was solely responsible for conducting the workshops and is hereafter referred to as the instructor.

An informal survey, conducted at the start of the workshops, revealed that four of the participants had

little or no prior knowledge of E-Z Logo or Apple Logo. It was noted that these participants worked at a slower pace throughout the workshops and did not grasp the commands and concepts as quickly as the other four more experienced participants. Progress of the target group was monitored and assessed after each session. Based on these assessments, the content and pacing of the lessons were revised to meet the diverse needs of both groups in the target population. The final lesson plans are in Appendix J:79.

Summary of Workshops

In the summary of workshops that follows, weeks one through six refer to the workshops; these weeks correspond to weeks five through ten of the implementation period. The individual workshop sessions are referred to sequentially as sessions one through twelve.

During week one, E-Z Logo shape and color commands were introduced and the concept of repeating design patterns was explored. The lesson plan for session one was E-Z Logo Design Patterns (Appendix J:79). The instructor introduced the basic E-Z Logo keystroke commands (F, B, R, L and C) and the location of the

shape and color commands available in E-Z Logo 2. These commands are listed on page 3 of the study guide (Appendix H:65). The instructor created several designs by repeating one of the basic patterns [shape turn], [shape turn turn] or [shape turn turn turn]. Using the worksheet on page 4 of the study guide (Appendix H:65), the participants created similar designs. The participants who had little or no prior knowledge of E-Z Logo focused on basic turtle movements and the keyboard location of the shape commands, while the participants who had some prior knowledge of E-Z Logo were able to focus on the concept of using repeating patterns to create designs.

In session two, the instructor explained the Total Turtle Trip (TTT) Theorem and related it to the concept of repeating designs. The lesson plan, Repeating Designs and the Total Turtle Trip Theorem, is located in Appendix J:81. Participants with no prior knowledge of E-Z Logo continued creating designs, focusing on the concept of repeating patterns. They used the worksheet on page 4 of the study guide (Appendix H:65). Participants who had prior knowledge of E-Z Logo analyzed the design patterns on page 5 of the study

guide (Appendix H:65). This group also created and analysed additional design patterns that included the use of two or three sizes of a shape within the basic pattern (i.e. [shape shape turn] and [shape shape shape turn] as opposed to the simpler pattern [shape turn]). At the conclusion of the lesson, the instructor reviewed the Total Turtle Trip (TTT) Theorem and the concept of repeating patterns. The participants were referred to the explanation of these concepts on page 2 of the study guide (Appendix H:65).

During week two, the concepts of creating procedures and using procedures within larger procedures were introduced. E-Z Logo workspace and disk commands were also introduced. In session three, the instructor presented the lesson Creating E-Z Logo Procedures (Appendix J:83). The E-Z Logo commands U, D and X and the workspace commands "S" for saving procedures and "G" for getting procedures were demonstrated. The instructor explained that the workspace is a temporary way to save procedures and that instructions for saving files to the disk would be given at the conclusion of the workshop. The workspace commands "N" for names and "Z" for zapping (or erasing) procedures were introduced

to individual participants as they were needed. The participants were asked to produce the pictures shown on page 8 of the study guide (Appendix H:65) and create procedures by "saving" the commands in the workspace. Although planning and recording of commands was stressed, many participants did not follow through on this idea. As a result, they experienced much difficulty drawing the pictures suggested in the lesson. The participants with less E-Z Logo experience preferred to continue exploring the shape commands and creating design patterns. This group used the worksheets on pages 4 and 5 of the study guide (Appendix H:65). Although most participants were able to save and get procedures from the workspace, the participants clearly confused the concepts of saving procedures in the workspace and saving files to the disk, as many participants "powered down" prior to saving their files to the disk. After reminding the participants of the explanation given earlier in the lesson, the instructor made a note to stress this concept in the next lesson.

In session four, the instructor demonstrated the concept of using procedures within larger procedures. The lesson plan for this session was Combining E-Z Logo

Procedures (Appendix J:85). The instructor referred participants to page 10 of the study guide (Appendix H:65) which shows various "scenes" created using the pictures from the previous lesson. Because many participants "powered down" prior to saving files to the disk, they had to re-create procedures for specific pictures from the previous lesson. Since most of the participants failed to record the commands used to create the procedures originally, re-creating these pictures was more difficult. To expedite the process, the workshop facilitator offered participants the E-Z Logo file containing procedures for the pictures from session three. It is noted that, despite the difficulties the participants were experiencing, most of them preferred to re-create the pictures on their own. The less experienced Logo participants eventually requested the picture file. Although no participants were able to create "scenes" by the end of the session, most participants demonstrated a better understanding of the commands and concepts. The instructor assisted participants in saving files to the disk at the end of the session.

During week three, commands and concepts from the previous weeks were reviewed and Apple Logo was introduced. In session five, the instructor discussed the E-Z Logo disk commands and workspace commands in detail and referred the participants to the summary of these commands on page 11 of the study guide (Appendix H:65). Several participants had difficulty understanding that a single file (with one specific name) contains several procedures (each with different names). They were able to understand the concept when it was related to a child's cumulative folder (a file with one specific name) that contains various papers (a record of grades, a sheet containing test scores, a health record, etc.). Participants continued working on creating pictures and scenes.

In session six, the instructor presented the lesson Introduction to Apple Logo (Appendix J:87). The transition from E-Z Logo to Apple Logo emphasized the similarities of the two pieces of software. The basic Apple Logo commands: FD, BK, RT, LT, CS, PU, PD, ST and HT were introduced. The instructor pointed out the differences in the syntax of the commands and explained various error messages. The circle commands (CIRCLER

and CIRCLEL) and color commands (SETPC and SETBG) were also introduced and explained. A summary of these commands appears on page 11 of the study guide (Appendix H:65). Participants used the worksheet on page 12 of the study guide (Appendix H:65) which contains various introductory activities designed to reinforce the Apple Logo commands. The less experienced participants had difficulty making the transition to Apple Logo and required the most assistance. Difficulty with turtle movements was coupled with difficulty in remembering the syntax of the commands. The instructor stressed that the turtle can only move FD and BK and can only turn RT and LT. The input required for RT and LT seemed to cause the most confusion. The instructor encouraged these participants to "play turtle" and stressed the fact that a right angle is 90 degrees. Several of the more experienced participants asked questions that revealed to the instructor that they were ready to learn the REPEAT command. The command was introduced to this group using the example of a dotted line. After explaining the syntax of the REPEAT command, the instructor asked the participants to draw a square and a triangle using this command.

During week four, the REPEAT command was introduced to the less experienced participants; writing procedures were introduced to the more experienced participants. In session seven, the instructor worked closely with the less experienced participants as they continued to explore Apple Logo commands in the immediate mode. They used the worksheet from the initial Apple Logo lesson on page 12 of the study guide (Appendix H:65). After a brief review of the REPEAT command, the more experienced participants used the worksheets on pages 13 through 15 of the study guide (Appendix H:65) to further explore this command. While the participants realized the desirability of using the REPEAT command, they had difficulty choosing the correct sequence of commands to include within the REPEAT. The participants were encouraged to work together and "play turtle" when logic errors and unexpected results occurred. The instructor also suggested that the participants break the picture into segments and identify the sequence of commands for an individual segment before incorporating the REPEAT command. At the request of the instructor, one participant, who had prior knowledge of Apple Logo, assisted the less experienced participants while the

instructor introduced the more experienced participants to the process of writing procedures. The introduction was based on the lesson Writing Logo Procedures. (Appendix J:91). The instructor explained a sample procedure that created a square, and the participants entered this procedure in the computer.

In session eight, the instructor reviewed repeating patterns and the TTT Theorem using the lesson plan titled Repeat Command (Appendix J:89) and referred the participants to the background information located on page 13 of the study guide (Appendix H:65). The instructor assisted the participants in loading the file SHAPES from the sample programs disk that accompanies the study guide. The program listings for this file are located in Appendix I:68. After creating a design together, the less experienced participants proceeded to enter those commands. The instructor reviewed the steps for creating procedures with the more experienced participants. This group created procedures for the worksheet on page 17 of the study guide (Appendix H:65). Although the editing of procedures had not been formally introduced, one participant, who had prior knowledge of the editing commands, voluntarily assisted the

participants when problems arose. This allowed the instructor to assist the less experienced participants. This group used the same worksheet, although they created designs in the immediate mode.

During week five, writing procedures were introduced to the less experienced participants; the editing commands were introduced to the more experienced participants. Arc commands were introduced to all of the participants. In session nine, the less experienced group worked on activities from the previous lesson. They used the file SHAPES from the sample programs disk and the worksheet on page 17 of the study guide (Appendix H:65). The instructor introduced editing commands to the more experienced participants by using the lesson Editing Procedures (Appendix J:93). The instructor loaded the file MISTAKES from the sample programs disk and referred the participants to the editing commands and worksheet on pages 18 through 19 of the study guide (Appendix H:65). Using the procedure HOUSE, from the file MISTAKES, the instructor demonstrated the editing commands and explained the types of errors the participants would encounter. The participants then proceeded to edit and debug the other

procedures listed on the worksheet. The instructor presented the lesson Writing Procedures (Appendix J:91) to the less experienced participants and worked with this group to create procedures using procedures from the file SHAPES.

In session ten, the instructor introduced the lesson Arcs (Appendix J:97) to all the participants. After the instructor explained the syntax of the command, the participants loaded the file LOOPS from the sample programs disk. The instructor explained how to use DEMO, a procedure that demonstrates various arc pictures, and how to see the contents of each individual procedure (PO "name of command). The participants used the worksheet on page 25 of the study guide (Appendix H:65) and the procedure DEMO to further explore the arc command. One of the worksheet activities suggested various pictures that incorporated the arc command. The more experienced participants created procedures for these pictures, while the less experienced participants preferred to work in the immediate mode.

During week six, the heading and position commands and the use of variables within procedures were introduced. Key concepts were reviewed and evaluation

instruments were administered. In session eleven, the instructor presented the lessons, Heading and Position Commands (Appendix J:99) and Variables (Appendix J:95). The follow-up activities listed below were revised to meet the needs of the participants and to accommodate the length of the workshop session. After introducing the heading and position commands, the instructor referred to the worksheets on pages 27 through 28 of the study guide (Appendix H:65) but suggested that participants explore these commands in depth later on in the workshop. The instructor then explained the concept of variables within procedures and showed the participants how to use a variable to write a procedure. After observing that the participants were able to enter the procedure to create squares of various sizes, the instructor referred to the background information and additional activities on pages 20 through 23 of the study guide (Appendix H:65). Some of the more experienced participants loaded the file PAPER.DOLL and worked on the heading and position commands; while others chose to continue experimenting with variables. The less experienced participants worked with the instructor to create another procedure using various

sizes of squares. In session twelve, the instructor reviewed key concepts and administered the evaluation instruments. Participants completed the Post-Implementation Survey (Appendix K:103) and evaluated the study guide (Appendix L:104).

Monitoring

The use of E-Z Logo during the initial workshop sessions was designed to provide the participants with a fundamental knowledge of Logo programming concepts and to develop familiarity with basic turtle movements. During these initial workshop sessions, the instructor observed that the participants with no prior knowledge of E-Z Logo had difficulty recalling basic turtle commands and anticipating turtle movements. All participants had difficulty drawing pictures and understanding the difference between the workspace and the disk. Although proficiency with E-Z Logo is not essential for learning Apple Logo, it is essential for those teachers whose students use E-Z Logo. For this reason, the use of E-Z Logo was extended from three sessions to five sessions.

By the time Apple Logo was introduced in session six, the participants fell into two distinct groups.

This author observed that the less experienced participants were apprehensive about making mistakes and lacked certain general computer literacy skills, which hindered their progress. Although the more experienced participants were able to grasp the commands and concepts at a faster pace, they, too, were not able to progress as quickly as this author originally anticipated. In sessions seven through nine, the instructor provided separate lessons and activities for each group. While the content of the lessons generally followed the plans in Appendix J:79, the assessments and pacing of the lessons were revised to meet the needs of each group. The instructor used this strategy because of the philosophy that Logo learning should be guided, not forced, and that an effective Logo environment encourages discovery-based learning. While the strategy of presenting two separate lessons significantly reduced the amount of time the instructor was able to interact with and assist the participants, there was a positive outcome as a result of this strategy. The instructor observed that the more experienced participants began to interact extensively, relying less on the instructor and assisting each other when problems arose. The less

experienced group also began to interact with one another, although they were not able to be as much assistance to each other.

In an effort to expose the participants to as many commands as possible, the instructor presented variables and the arc plus the heading and position commands to the entire group in sessions ten and eleven. The follow-up activities for these lessons were revised to meet the needs of each group. The experienced participants, more comfortable with the concepts of writing and editing procedures, were able to create procedures using the commands; while the less experienced participants preferred to work in the direct mode. Because the more experienced group was able to work independently after the commands were presented, the instructor was able to concentrate on assisting the less experienced group.

Chapter IV

Results

The author of this practicum evaluated each objective of the practicum. The first objective was that by the end of the implementation period, 100 percent of the participants would demonstrate the ability to use 17 out of 24 Logo commands/concepts. This would be demonstrated by the participants' ability to develop a procedure that produced a picture. Because the participants were unable to grasp the commands and concepts as quickly as this author anticipated, the author revised the content and pacing of the workshop lessons. Apple Logo was not introduced until the end of week three. Writing and editing procedures, which were necessary to develop a procedure that would produce a picture, were not introduced until week five. Only 14 of the planned 24 commands/concepts were introduced during the implementation period. As a result, the participants were unable to reach the level of expertise necessary to achieve objective one prior to the end of the workshops. The wide range of the participants' abilities and the need to modify the number of

commands/concepts taught made the attainment of the first objective an impossibility. The author believes that this objective might have been met if each workshop session was longer or if additional workshop sessions were conducted.

Objective two measured a change in positive attitude regarding the use of Logo. The second objective was that by the end of the implementation period, the participants would demonstrate a positive attitude regarding the use of Logo as evidenced by a 50 percent increase in affirmative responses to questions 5, 6 and 7 on the Survey of Logo Use (Appendix D:59) and questions 4 and 5 on the Survey of Gifted (Appendix A:56). These questions were taken directly from the two survey forms (Appendices D:59 and A:56) given prior to implementation and formed the Post-Implementation Survey (Appendix K:103) that the author administered during the final workshop. The results of this survey are shown in Table 2.

Table 2
Results of the Post-Implementation Survey

Question	Positive Responses		Amount of Change
	Before	After	
1. Do you think you have adequate knowledge to teach Logo/E-Z Logo to your students?	20%	100%	60%
2. Do you think you have adequate materials and ideas to teach Logo/E-Z Logo to your students?	0%	100%	100%
3. Do you think that your lack of knowledge of Logo/E-Z Logo discourages you from using it with your students?	33%	100%	67%
4. Would you allow or encourage gifted students to use Logo during a computer lab session?	47%	100%	53%
5. Would you allow or encourage gifted students to use Logo when the computer is in your classroom?	47%	100%	53%

Table 2 shows that the eight participants gave positive responses to all the questions on the Post-Implementation Survey (Appendix K:103). Questions 1 and 3 assessed the participants' cognizance of the knowledge they acquired as a result of the workshops. These results were particularly significant given the fact that four of the eight participants had no knowledge of E-Z Logo or Apple Logo prior to the workshops. This significance became more pronounced in light of the fact that objective one, which dealt exclusively with the acquisition of Logo knowledge, was not accomplished. Question 2 addressed the availability of materials and ideas to teach Logo/E-Z Logo. This author attributed the 100 percent positive response to this question to the variety of activities contained in the study guide (Appendix H:65). Questions 4 and 5 assessed the participants' willingness to allow or encourage gifted students to use Logo in the computer lab and in the classroom. These questions both showed a 53 percent increase, the lowest increase of all the responses. This author conjectured that the 47 percent positive response to these two questions prior to

workshops indicated that the gifted students were allowed to use Logo, even though the teachers did not have the knowledge and confidence to teach Logo. This author concluded that future use of Logo will include the teaching and reinforcing of skills at the author's school. This objective was met because the increase in positive responses ranged from 53 percent on questions 4 and 5 to 100 percent on question 2.

Objective three measured the overall effectiveness of this practicum. This objective was that over a period of three weeks following implementation, at least one teacher per grade level would initiate plans to use Logo activities in the classroom or computer lab. The sign-up sheet (Appendix E:61) placed in the computer lab, showed that 100 percent of the participants in the target population used the Logo activities at least once during this time period. The software sign-out sheet for software that left the lab (Appendix F:63) showed that each teacher who had access to a computer in the classroom signed out E-Z Logo or Apple Logo. These results showed that objective three was met.

The goal of this practicum was to provide teachers with the knowledge and confidence to teach Logo as a

part of the regular computer curriculum. The author of this practicum provided the knowledge needed to teach Logo through workshops and a study guide (Appendix H:65). After the workshops, the teachers displayed confidence in their ability to teach Logo as demonstrated by their use of Logo activities in the computer lab and the classroom. Although only two of the three specific objectives for this practicum were met, the general goal of the practicum was achieved. For this reason, the author of this practicum maintained that the strategies implemented were effective, and the practicum was successful.

Chapter V

Recommendations

As a result of this practicum, the teachers in the target population began using Logo activities with their students. This author observed these teachers using the study guide as both a reference for background information and a resource for activities and ideas. The target groups' evaluations of the study guide, summarized in Appendix L:104, indicated the need for several minor changes in the organization of the guide. The revision of the lesson plans also resulted in minor changes to the content of the study guide. The revisions to the study guide included expanding the explanation of E-Z Logo procedures and creating an additional worksheet for the REPEAT command. The E-Z Logo keyboard and workspace commands were placed in both the body of the guide and the reference pages at the end of the guide. The author will make these revisions, and disseminate the revised guide to the teachers in the target population. Additional copies of the revised guide will be placed in the computer lab. This author believed that the teachers who use Logo would need

continued support and guidance. Although informal discussions might serve to meet this need, additional workshops to extend the teachers' knowledge would be needed. Additional workshops would facilitate the sharing of ideas and activities and provide the impetus for further integration of Logo into the curriculum.

This author has presented the results of this practicum to the South Area Computer Curriculum Supervisor and the gifted curriculum supervisor. The South Area Computer Curriculum Supervisor has agreed to consider the possibility of making the computer programs and study guide available to all teachers in the county's South Area as a resource for those who wanted to implement Logo into their computer lessons. The gifted curriculum supervisor has agreed to meet with this author to discuss ways that the computer programs and study guide can be used to enrich computer education and improve the carry-over of computer skills into the regular computer classroom. Furthermore, this author plans to share the materials developed for this practicum by making presentations at computer conferences and conferences for the gifted.

This author hopes that the lessons developed for each workshop session can be shared with other workshop facilitators who are teaching the Logo programming language to teachers. During the implementation period, the author of this practicum noted several factors that affected the content and pacing of the lessons: the degree of computer literacy, the prior knowledge of Logo/E-Z Logo, and the mathematics background of the participants. In addition, the individual learning style of each participant influenced that person's ability to independently explore and experiment with the concepts. While these factors directly influenced the level of Logo knowledge the participants acquired during the course of the workshops, this author believed that the adaptations made to meet these varying needs positively impacted the participants' attitudes about Logo. The author's summary of these recommendations and considerations (Appendix M:108) will be included in any materials that are disseminated to other workshop coordinators.

REFERENCES

Bailey, Harold J., Kathleen M. Barutigan, and Trudy H. Doran. Apple Logo Activities for Exploring Turtle Graphics. Bowie, MD: Brady Communications Company, Inc., 1984.

Barclay, Tim, Kathleen Martin and Tim Riordon. "Honoring Students' Knowledge of Logo," The Computing Teacher. November 1985, pp.22-25.

Billstein, Rick. "Learning Logo and Liking It." The Computing Teacher.10(3).November 1982,pp.18-20.

Bull, Glen. "Microworlds," The Computing Teacher.10(3).November 1982,pp.62-63.

Bull, Glen, and Steve Tipps. "Problem Spaces in a Project-Oriented Logo Environment," The Computing Teacher.11(5).December/January 1983-84,pp.54-57.

Clements, Douglas H. "Supporting Young Children's Logo Programming," The Computing Teacher.11(5).December/January 1983-84,pp.24-29.

Combs, Martha. "Exploring the Composing Process with Microcomputers." Journal of Library Science. ERIC ED 267 424.

Cron, Mary. "Trouble in Logoland," Teaching, Learning, Computers.1(2).December 1983,pp.59-65.

Davis, Edward J., Jim Helms, F.A. Norman, and Joao Ponte. "Training Elementary School Teachers to Use Computers -- with Emphasis on Logo," The Arithmetic Teacher.October 1984,pp.18-25.

Delcos, Victor R., Joan Littlefield, John D. Bransford. "Update on Microcomputer Use in Instruction Teaching Thinking Through LOGO: The Importance of Method," Roeper Review.7(3).February 1985,pp.153-159.

Elementary Computer Literacy Curriculum Guide. (1985). The School Board of Broward County Florida.

Harvey, Brian. "Why Logo?," Byte. August 1982, pp.163-172.

Jensen, Rita A., and John Wedman. "The Computer's Role in Gifted Education," G/C/T.25.November/December 1982, pp.10-11.

Leron, Uri. "Logo Today: Vision and Reality," The Computing Teacher.12(5).February 1983, pp.26-32.

Lough, Tom. "Exploring New Horizons With LOGO How One School Is Charting the Course," Electronic Learning.2(7).April 1983, pp.71-74.

Moursund, David. "Logo Frightens Me," The Computing Teacher.11(5).December/January 1983-84, pp.3-4.

Powers, Cathy M. "Using the Computer Language Logo For The Purpose of Improving Reasoning Skills in Four and Five Year Olds." Unpublished Dissertation. Nova University, 1985.

Riordon, Tim. "Creating a Logo Environment," The Computing Teacher.10(3).November 1982, pp.46-50.

Torgerson, Shirley. "Computers, Gifted Students and The Enrichment Triad," The Computing Teacher.13(1).August/September 1985, pp.9-15.

Upitis, Rena. "Logo and the Primary-Junior Pupil: One Student's First Encounter," The Computing Teacher.10(3).November 1982, pp.28-31.

Watt, Dan. "Teaching Turtles: Logo as an Environment for Learning," In Al P. Mizel, Ed.D. & Thomas H. Beebe, Ph.D. (Eds.), Computer Education Book of Readings (88-91). Lexington, MA: Ginn Custom.

Watt, Molly. "What is Logo?," Creative Computing. October 1982, pp.112-125.

APPENDICES

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APPENDIX A

SURVEY OF GIFTED AND RESULTS

1. Have you ever had any students in your class who were identified as "Gifted"?

Yes 93% No 7%

2. Do you have any students in your class this year who are identified as "Gifted"? If so, how many?

Yes 40% No 60%

3. If "no" to question 2, do you anticipate ever having students in your class who are identified as "Gifted"?

Yes 100% No 0%

4. Would you allow or encourage gifted students to use Logo during a computer lab session conducted by you as the classroom teacher?

Yes 47% No 53%

5. Would you allow or encourage gifted students to use Logo when the computer is in your classroom?

Yes 47% No 53%

APPENDIX B

*The Nation's Largest Fully**Accredited School System***THE SCHOOL BOARD OF**

Director
 Exceptional Student Education
 Florida

Chairperson
 Vice Chairperson

August 31, 1987

Ed D
 Superintendent

TO: Christie Lis, Teacher of Gifted

FROM: , Curriculum Supervisor
 Gifted Program

RE: Computer Curriculum for Gifted Students

Based on our discussion at the Inservice Workshop on August 27th, I would like to describe a growing need for the elementary gifted population. As you are aware, the gifted program in the elementary years is delivered as a part time pull-out program. The intent of the program is to develop the enabling skills necessary for our students to maximize their gifted potential. Toward that end, computers have been an integral part of the gifted curriculum, as much so as language arts, math, social studies, and science. Logo has proved to be a most appropriate language for this curriculum area of the program.

With enriching language arts, math, etc., the carryover to the regular classroom has improved through our development of a curriculum guide for regular education teachers.

The need I see in computer education is to train regular education teachers (those responsible for teaching county computer curriculum,) so that they have a working knowledge of logo. This training will ensure the same carryover of skills from the gifted program into the regular classroom in computer education, as is currently evident in the other curricular area.

I hope this serves to clarify an obvious educational need and that your practicum work will address solutions to the problem. If I can be of further assistance, please feel free to call me at

APPENDIX C

August 21, 1987

Computer Curriculum Specialist
Curriculum Office

Florida

Christie Lis
Computer Teacher
Elementary

Dear Ms Lis;

Thank you for your visit to my office last week. Your enthusiasm and interest in improving elementary teaching strategies through Logo is a worthwhile endeavor. After consulting a number of elementary school-based computer teachers, elementary classroom teachers, curriculum specialists, and principals, I found your integration and application of the Logo language to be not only very appropriate but also a much needed commodity.

As we discussed, classroom teachers need additional creative avenues to reach the individual learning styles of students. Logo is a perfect means to incorporate computer literacy skills with not only minimum basic skills but with program objectives and standards of excellence in all curriculum areas.

Should you need any assistance in the development and/or implementation of these Logo activities and teacher training, please do not hesitate to call. We are anxiously awaiting your end product to share with all of the Elementary teachers.

Sincerely,

Computer Curriculum Specialist
Curriculum Office

APPENDIX D

SURVEY OF LOGO USE AND RESULTS

1. Do you use Logo/E-Z Logo with your students?

Yes 47% No 53%

2. Are you aware of the suggested Logo/E-Z Logo lessons in the computer curriculum guide?

Yes 47% No 53%

3. Do you use those lessons with your students?

Yes 13% No 87%

4. Are you aware of the skills (computer literacy and other) that can be taught using Logo/E-Z Logo?

Yes 27% No 73%

5. Do you think you have adequate knowledge to teach Logo/E-Z Logo to your students?

Yes 20% No 80%

6. Do you think you have adequate materials and ideas to teach Logo/E-Z Logo to your students?

Yes 0% No 100%

7. Do you think that your lack of knowledge of Logo/E-Z
Logo, discourages you from using it with your students?

Yes 67% No 33%

8. Would you attend a school-based workshop on Logo?

Yes 73% No 27%

9. Would you like additional materials and teaching
techniques for using Logo with your students?

Yes 100% No 0%

APPENDIX E

COMPUTER LAB SOFTWARE SIGN-UP SHEET

<u>Date</u>	<u>Teacher Number</u>	<u>Grade Level</u>	<u>Software Used in Lab Lesson</u>
2/23	107	5	Word processing
2/24	704	1	E-Z Logo.
2-24	221	2	Mecc Math.
2-24	103	7	mecc math.
2-26	720	3	Logo
2-26	1201	2	EZ Logo
2-26	423	3	EZ Logo
2-28	31	1	-
3-1	107	5	LOGO
3-1	704	1	EZLOGO
3-2	221	2	EZ Logo
3-2	103	4	Logo
3-4	720	3	Logo
3-4	1201	2	E-Z Logo
3-4	423	3	Teena Practice Disk
3-4	107	1	EZ Logo
3-8	107	5	Logo
3-9	704	1	EZLOGO

APPENDIX E

COMPUTER LAB SOFTWARE SIGN-UP SHEET

<u>Date</u>	<u>Teacher Number</u>	<u>Grade Level</u>	<u>Software Used in Lab Lesson</u>
3-9-88	221	2	E-Logo
3-9-88	103	4	Logo
3-11-88	720	3	Logo
3-11-88	1201	2	EZ Logo
3-11-88	423	3	Logo
3-11-88	107	1	EZ Logo

APPENDIX F

SOFTWARE SIGN-OUT SHEET

<u>Date</u>	<u>Teacher Number</u>	<u>Grade Level</u>	<u>Software Checked Out</u>	<u>Date Returned</u>
2-24.	221	2	E-Z-Logo	3-4-
3-4	720	3	Logo	

APPENDIX G

THE SCHOOL BOARD

The Nation's Largest Fully Accredited School System

Principal

Chairperson

Vice Chairperson

Superintendent
Ed.D.

October 23, 1987

Mrs. J. Christie Lis
601 SW 2nd Street
Hallandale, Florida 33009

Dear Mrs. Lis:

Based on our recent discussion concerning your practicum, please feel free to use our computer lab facilities and software to complete your project.

I am enthusiastic about your plan to provide the training and resources that will enhance our use of computers with gifted students. I know your project will be beneficial to our students and your fellow colleagues.

Keep me posted as to your progress and let me know if I can be of further assistance.

Sincerely,

Principal

APPENDIX H
Logo Workshop Study Guide

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INTRODUCTION TO E-2 LOGO

E-2 Logo is a version of Logo produced by the Minnesota Educational Computing Consortium (MECC). As the name implies, E-2 Logo is a simplified version of Logo. Because the commands are single keystrokes, E-2 Logo is often used with younger children. The program menu offers two versions, E-2 Logo 1 and E-2 Logo 2. The commands for both versions are identical with the exception of the activities and functions noted below. E-2 Logo 1 contains a set of 24 activities and mazes. To use these activities, choose E-2 Logo 1 from the menu. When the turtle appears, press "A" for activity and a number between 1 and 24. E-2 Logo 2 contains single keystroke commands for squares, circles, triangles and rectangles. This version also allows the user to create procedures and access the disk commands to save work to the disk.

The E-2 Logo activities in this guide use E-2 Logo 2. The commands are explained throughout the guide as they are introduced. A summary of the commands appears on pages 33-34. Specific instructions for E-2 Logo 1 can be found in the manual that accompanies the E-2 Logo disk.

TOTAL TURTLE TRIP THEOREM

The rule of 360 or the Total Turtle Trip Theorem (TTT Theorem) is an important concept in Logo. It is based on the geometric concept that 360 degrees is a complete circle. The explanation that follows shows how the TTT Theorem relates to the idea of repeating-patterns. The designs on pages 4-5 can be created by repeating the patterns shown below:

[shape turn] [shape turn turn] [shape turn turn turn]

The E-Z Logo turtle turns 30 degrees each time "R" or "L" is pressed. Pressing "R" or "L" three times consecutively turns the turtle 90 degrees (a right angle). Pressing "R" or "L" 12 times consecutively turns the turtle 360 degrees (a complete circle). By repeating a pattern until the turtle turns 360 degrees, a "complete" design can be created. The chart below shows the mathematical correlation for each pattern using multiplication and division. Younger students can be shown the correlation using repeated addition or subtraction.

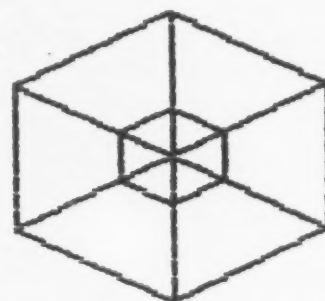
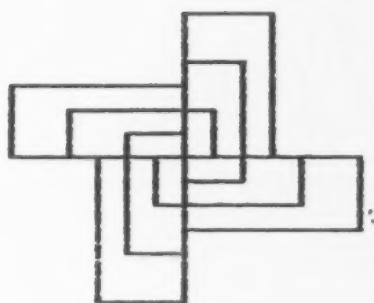
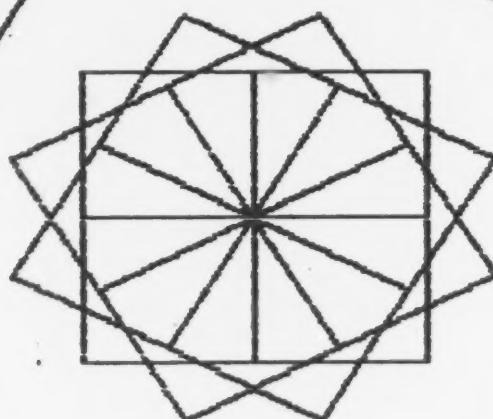
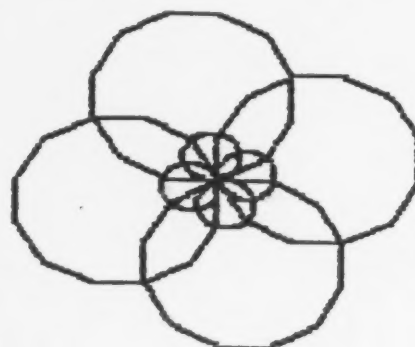
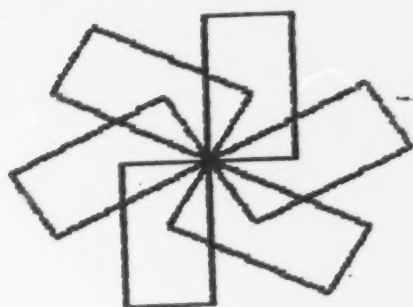
Pattern	# of degrees turned	Mathematical correlation	# of repeats
[shape turn]	30	$30 \times 12 = 360$	$360/30 = 12$
[shape turn turn]	60	$60 \times 6 = 360$	$360/60 = 6$
[shape turn turn turn]	90	$90 \times 4 = 360$	$360/90 = 4$

Partial designs can be created by turning the turtle less than 360 degrees. If the turtle turns a total of:

90 degrees then $1/4$ a design is created ($1/4 \times 360 = 90$).
 180 degrees then $1/2$ a design is created ($1/2 \times 360 = 180$).
 270 degrees then $3/4$ a design is created ($3/4 \times 360 = 270$).

REPEATING PATTERNS WORKSHEET

1. Identify the pattern and number of times the pattern was repeated in each of the designs below.



2. Match each of the repeating patterns below with the corresponding designs on page 5.

a. SQ R R R (4 times)

b. TRI TRI R (12 times)

c. CIR R (12 times)

d. CIR CIR R R (6 times)

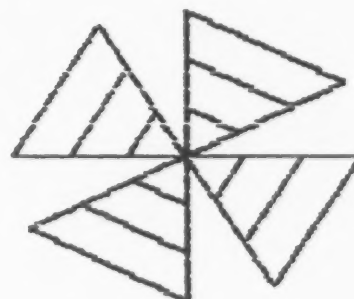
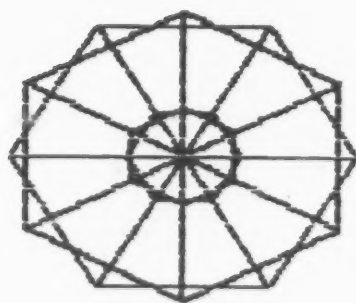
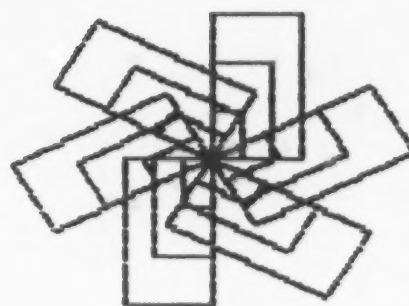
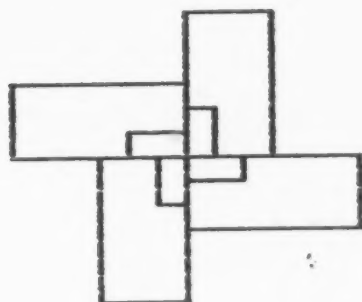
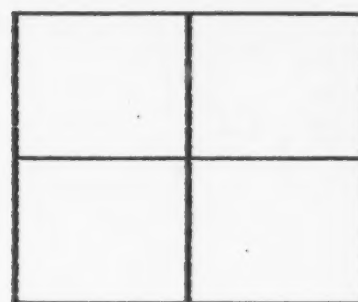
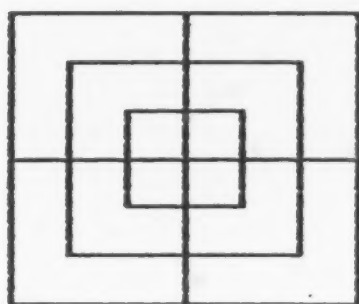
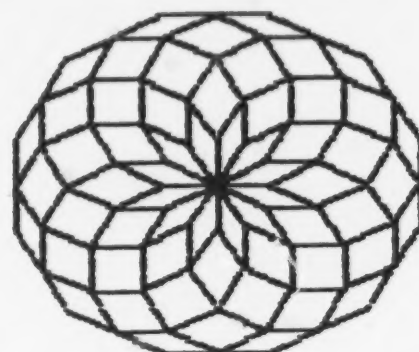
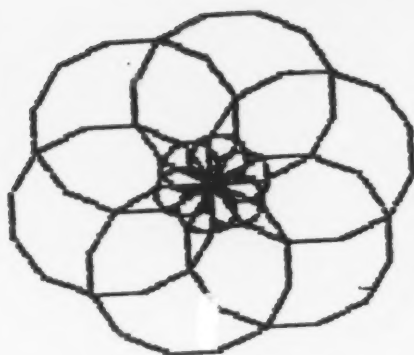
e. REC REC REC R R (6 times)

f. SQ SQ SQ R R R (4 times)

g. TRI TRI TRI R R R (4 times)

h. REC REC R R R (4 times)

REPEATING PATTERNS WORKSHEET 2



HINTS FOR USING DESIGN PATTERNS WITH STUDENTS

Encourage students to experiment with design patterns. They often create designs without being aware of the repeating pattern or the mathematical correlation. The suggestions below are intended for those students who are "ready" to make the connection between the concept of repeating patterns and the TTT Theorem.

Have a partner write the commands used to create one of the designs. Ask students to look for a repeating pattern. Make a chart showing the patterns and the number of times each pattern was repeated. Help students see the relationship between the number of turns and the number of repeats. Guide their thinking and interject the concept of 360 degrees to those students who are "ready" for it.

Do not be concerned if students are unable to grasp the correlation. Forcing the concept on students who are not ready will only result in frustration. Instead, concentrate on fostering an environment that encourages students to experiment and discover ideas on their own.

A set of task cards containing a variety of design patterns is available in the computer lab.

E-2 LOGO PROCEDURES

A procedure in Logo is a set of directions or commands. Once a procedure is created, the turtle can recall or "get" the directions from the workspace. Workspace refers to a space in the computer's memory where procedures are stored temporarily. In E-2 Logo 2, commands become a procedure when they are "saved" in the workspace.

CREATING PROCEDURE: Enter a series of commands. To save the commands, press "S". When SAVE PROCEDURE appears, type a name for the procedure and press RETURN. The commands now become a procedure, the screen is cleared and a new procedure can be started.

GETTING A PROCEDURE: To recall or GET a procedure, press "G". When GET PROCEDURE appears, type the name of a procedure that has been "saved" and press RETURN. The turtle performs all the commands entered for that procedure. To see another procedure, press "C" to clear the screen.

NOTE: Procedures in the workspace must be saved to the disk BEFORE RETURNING TO THE MAIN MENU OR BEFORE THE POWER IS SHUT OFF; otherwise, they will be erased. (See page 34 for an explanation of saving work to the disk.)

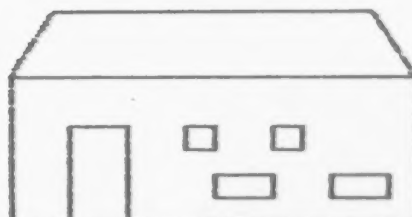
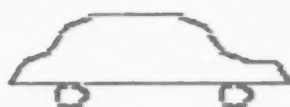
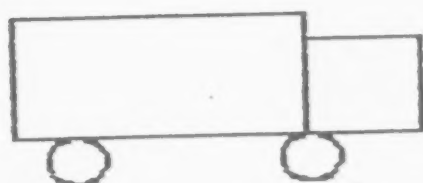
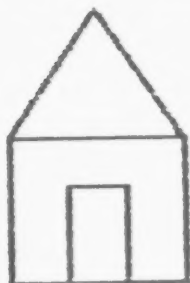
ADDITIONAL WORKSPACE COMMANDS

NAME-To see the NAMES of the procedures in the workspace, press "N".

ZAP-To erase or ZAP a procedure from the workspace, press "Z". When ZAP WHAT PROCEDURE appears, type the name of the procedure you wish to erase and press RETURN.

E-2 LOGO PROCEDURES WORKSHEET

Try to create the pictures shown below. Make a record of the correct sequence of commands. Clear the screen, re-enter the commands and save them as a procedure.



COMBINING E-2 LOGO PROCEDURES

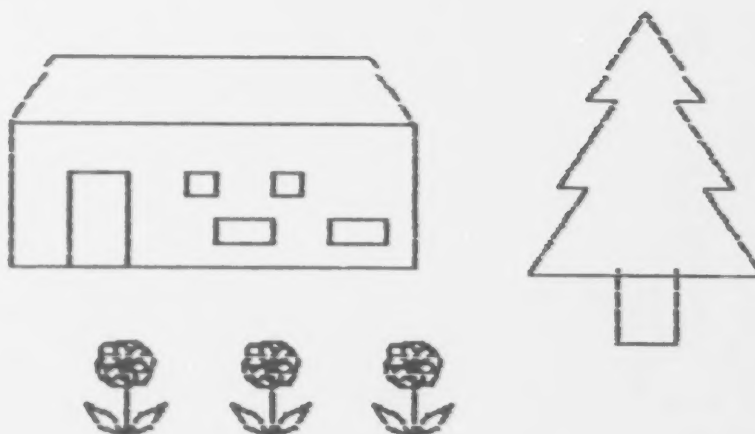
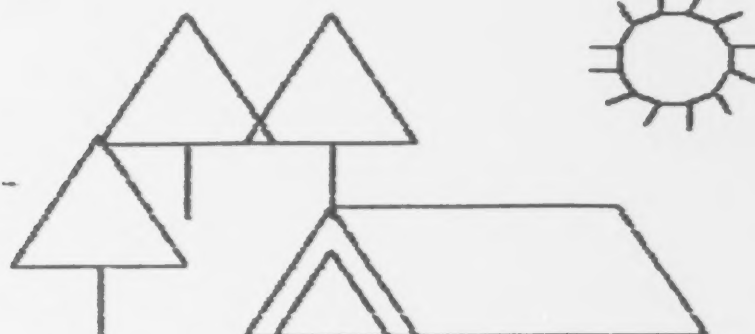
Procedures can be combined to create longer, more detailed procedures. Once a procedure is saved in the workspace, it can be used as part of another procedure. The GREENHOUSE shown below was created by combining several procedures. Three separate procedures, a house, a flower and a sun were created and saved. Create the GREENHOUSE procedure in the following manner:

1. Draw a horizontal line across the screen.
2. Move the turtle to the location for the house and "GET" house.
3. Move the turtle to the location for the flower and "GET" flower. Repeat this step until the desired number of flowers are on the screen.
4. Move the turtle to the location for the sun and "GET" sun.
5. Press "S" to save the procedure called GREENHOUSE.



COMBINING PROCEDURES WORKSHEET

Use the procedures created previously to create the scenes shown below.



E-2 LOGO/APPLE LOGO COMPARISON

The chart below shows a comparison of E-2 Logo and Apple Logo commands. The # indicates that a number is required with the command.

<u>E-2 Logo</u>	<u>Command</u>	<u>Apple Logo</u>
F	forward	FD #
B	back	BK #
R	right	RT #
L	left	LT #
not available	circle right	CIRCLER #
not available	circle left	CIRCLEL #
T	show turtle	ST
H	hide turtle	HT
C	clear screen	CS
U	pen up	PU
D	pen down	PD
X	pen erase	PE

APPLE LOGO COLOR COMMANDS:

COLORS

SETPC #	(set pen color)	0=Black	3=Violet
SETBG #	(set background color)	1=White	4=Orange
		2=Green	5=Blue

NOTE: Certain combinations of pen and background colors cause lines to appear jagged instead of smooth. This is caused by the way the signals are sent to the monitor. There is no way to correct this. The following combination of pen and background colors will not show up on one another: green/orange or blue/violet.

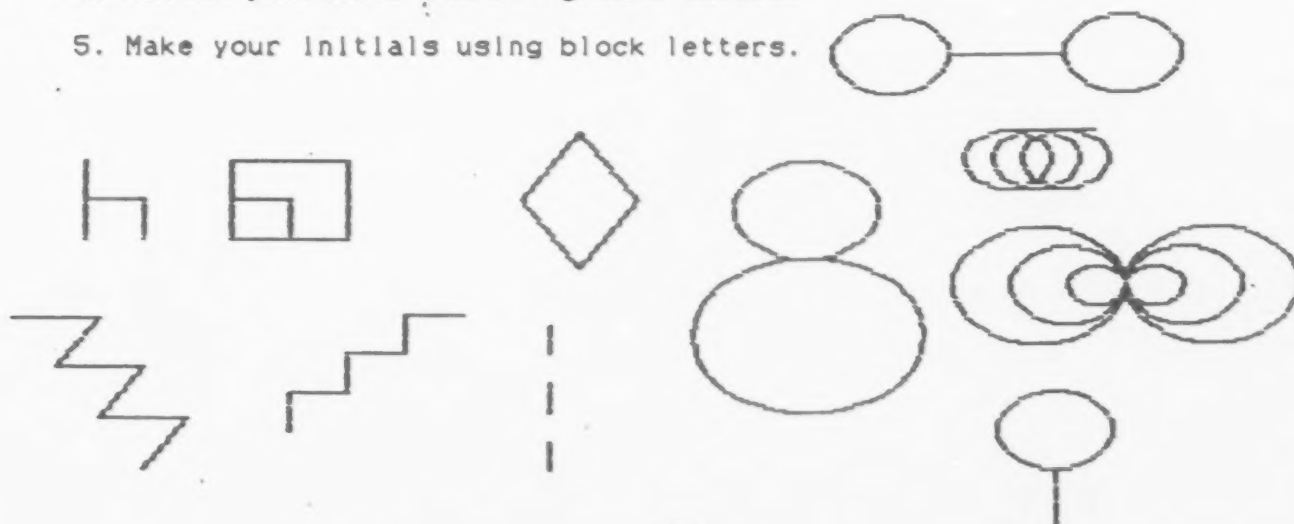
SCREEN COMMANDS: These commands are executed by pressing the CONTROL key in conjunction with another letter. They are not available in E-2 Logo.

Control-S	split screen	shows graphics and text
Control-T	text screen	shows only text
Control-L	full screen	shows only graphics

BEGINNING LOGO ACTIVITIES WORKSHEET

The activities listed below will help you gain an understanding of the Logo commands. You will be commanding the turtle in the immediate mode, therefore, you will not be able to save the work you do. You can use Control-T to see the commands you type but remember, once they roll off the screen you cannot get them back. Make notes and record important ideas in the margins below or in your Logo notebook. Remember to clear the screen (CS) between each activity.

1. Type FD # using a number between 1000 and 9000. Notice the effect.
2. Type RT # or LT # using a number < 90. Now type FD # using a number between 1000 and 9000. Continue experimenting by changing the pencolor and the turtle's direction.
3. Make a dotted line (_ _ _ _). Try making each part of the line a different color. Make the line at a different angle.
4. Experiment by trying to make the pictures below. Try using different pencolors and background colors.
5. Make your initials using block letters.



REPEAT COMMAND

The REPEAT command tells the turtle to repeat a set of directions a specific number of times. The format is:

REPEAT # [directions]

The # tells the turtle how many times to repeat the directions that are enclosed in the brackets []. The REPEAT command shown below would draw a dotted line such as this _ _ _ _.

REPEAT 4 [FD 10 PU FD 10 PD]

Although there are many applications for the REPEAT command, the most common use is in conjunction with geometric shapes and patterns. When REPEAT is used in this manner, it is important to understand the Rule of 360 or the Total Turtle Trip Theorem (TTT Theorem). Recall that the TTT Theorem is based on the geometric concept that 360 degrees comprises a complete circle or a total turtle trip. (Page 2 of this study guide discusses this concept in detail.) The design patterns on pages 4-5 were created using E-2 Logo which does not have a REPEAT command. These patterns can be shortened using the REPEAT command as shown below.

```
REPEAT 12 [shape RT 30]
REPEAT 6 [shape LT 60]
REPEAT 4 [shape RT 90]
```

In each of these examples, the # of repeats X the angle turned = 360. This concept can also be applied to the creation of basic geometric shapes. For example: REPEAT 4 [FD 40 RT 90] creates a square and REPEAT 3 [FD 40 RT 120] creates a triangle because the # of repeats X the angle turned = 360. REPEAT 3 [FD 40 RT 90] would not create a square or closed figure because $3 \times 90 = 270$, not 360.

REPEAT COMMAND WORKSHEET

1. Experiment to determine the sequence of commands that was repeated in the patterns shown below, and then use the REPEAT command to create the entire pattern. Below is a list of editing commands that work in the Immediate mode. By placing CS at the beginning of a line and using Control-Y, you can change mistakes without retyping an entire line. Remember to hold the Control key down while pressing the letter key.

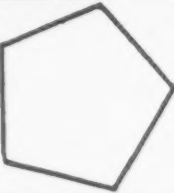
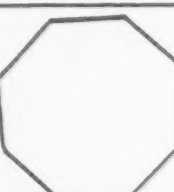
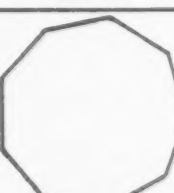
Command	Effect
Control-F (or -->)	move the cursor forward
Control-B	move the cursor back
Control-A	move cursor to beginning of the line
Control-E	move cursor to the end of the line
Control-D (or <--)	delete a character
Control-Y	YANK back the last line typed



2. Use the REPEAT command to create a square and a triangle. Recall the relationship between the # of repeats and the angle turned that was discussed on page 13.

3. Use the activities on page 15 to experiment further with the REPEAT command to make geometric shapes.

- Experiment with the REPEAT command.
- Discover and record the number of times to repeat and the number of degrees to turn to draw each closed shape below. (The turtle ends in the HOME position.)

Shape	Command
	REPEAT ____ [FORWARD 40 RIGHT ____]
	REPEAT ____ [FORWARD 40 RIGHT ____]
	REPEAT ____ [FORWARD 40 RIGHT ____]
	REPEAT ____ [FORWARD 40 RIGHT ____]
	REPEAT ____ [FORWARD 40 RIGHT ____]
	REPEAT ____ [FORWARD 40 RIGHT ____]

In the space below, write your rule for finding the number to REPEAT and the degrees to turn RIGHT to draw these shapes.

LOGO PROCEDURES

The steps for defining a procedure in E-Z Logo are:

1. Enter a set of commands.
2. Press "S" to save the procedure.
3. Type a procedure name and press Return.

Defining a procedure in Apple Logo differs slightly.

Procedures are named before the commands are entered. Key words tell the turtle when you are beginning and ending a procedure. When you define a procedure, you are teaching the turtle TO do something new. After you teach the turtle, you END the instructions. The key words are TO and END. The steps for defining a procedure are listed below.

1. Type TO and a one-word name for the procedure. Press RETURN and the cursor will change from ? to >.
2. Enter the commands for the procedure. Press RETURN when you have finished entering the commands. Note that the turtle remains inactive during this process.
3. Type END and press RETURN to tell the turtle you have ENDED the instructions.
4. (name of your procedure) DEFINED will appear on the screen to tell you that the turtle has learned a new command. The sample procedure below shows what appears on the screen when you define a procedure.

```
?TO BOX
>FD 20 RT 90
>FD 20 RT 90
>FD 20 RT 90
>FD 20 RT 90
>END
BOX DEFINED
```

NOTE: In order to "get" the procedure, simply type the name and press return.

WRITING PROCEDURES WORKSHEET

1. Load the file SHAPES. Type POTS to see the procedures that are in that file. Using these procedures, create procedures for the repeating designs from the worksheets on pages 4-5. When changing the E-Z Logo commands to Logo commands, remember to indicate the size of the shape (i.e. SQ must be SQ25, SQ50 or SQ75), and each turn R or L is equal to RT 30 or LT 30. Several examples are shown below.

E-Z Logo	Logo
SQ R R R repeated 4 times	REPEAT 4 [SQ50 RT 90]
TRI L repeated 12 times	REPEAT 12 [TRI75 LT 30]
SQ SQ R R repeated 6 times	REPEAT 6 [SQ75 SQ25 RT 60]

2. Create procedures using the pictures on the BEGINNING LOGO ACTIVITIES worksheet (page 12) and the REPEAT worksheet (page 14).

EDITING COMMANDS

Recall that E-2 Logo provided no means of editing or changing procedures other than to "ZAP" it and begin again. In Apple Logo, procedures can be changed or edited in the following manner:

Type ED "<name>" and press RETURN.

Notice that the message LOGO EDITOR appears at the bottom of the screen. Make the desired changes and press Control-C to tell Logo that you have COMPLETED editing. Below is a list of commands to assist in the editing process. Remember to hold the Control key down while pressing the letter key.

Command	Effect
Control-F (or -->)	move the cursor forward
Control-B	move the cursor back
Control-N	move the cursor to the next line
Control-P	move cursor to the previous line
Control-A	move cursor to beginning of the line
Control-E	move cursor to the end of the line
Control-D (or <--)	delete a character
Control-C	complete the editing process

The following commands will work in the IMMEDIATE mode.

Control-F Control-B Control-A Control-E
 Control-Y (This will YANK back the last line typed. It is
 used only in the immediate mode.) By placing CS at the
 beginning of a line and using Control-Y, you can change mistakes
 without retyping an entire line.

EDITING WORKSHEET

Tabitha Turtle drew a picture of a park, but she made several mistakes. To see the park correctly, you will need to edit certain procedures and create the shape procedures that she forgot to write. Load the file MISTAKES and use the hints below to help you "debug" PARK.

1. PARK is made up of several smaller procedures (HOUSE, TREE, DOG, STOPSIGN, SWING, and SEESAW). Correct each procedure separately.

2. HOUSE shows the three types of mistakes Tabitha made. Invoke HOUSE. As you correct each mistake, the next mistake will show when you invoke HOUSE again.

a. SYNTAX ERROR-I DON'T KNOW HOW TO LT18 IN HOUSE indicates that Tabitha forgot a space between LT and 18.

b. PROCEDURE LACKING-I DON'T KNOW HOW TO PENT50 IN HOUSE indicates that Tabitha forgot to teach the turtle to make a pentagon whose sides are 50.

NOTE: If the message I DON'T KNOW HOW TO _____ is a shape name (i.e. HEX, SQ or TRI), Tabitha forgot to write the procedure. The number indicates the size of the shape. Use it in the name WITHOUT a space.

c. LOGIC ERROR-(incorrect command or input #) Although the procedure runs without error, the picture is incorrect. Type ED "HOUSE and play turtle. Notice that LT 90 should be RT 90.

** The SETH command will be discussed in a later lesson. To assist you in correcting logic errors, SETH # turns the turtle as shown below:

SETH 0



SETH 90



SETH 180



VARIABLES

A variable is something that can change. In the math equation $X+Y=6$, X and Y are the variables. If $X=2$ then $Y=4$; if $X=1$ then $Y=5$. Variables make the number sentence more flexible. Variables make a Logo procedure more versatile and can be used in shape procedures to change the size of the shape. Each of the commands below will produce a square.

```
REPEAT 4 [FD 20 RT 90]
REPEAT 4 [FD 40 RT 90]
REPEAT 4 [FD 60 RT 90]
```

Notice that only the FD input changes. Without variables, a separate procedure is needed to draw each square. By using a variable, only one procedure is needed. In this case, the FD input becomes the variable, and the procedure would look like this:

```
TO SQUARE :SIZE
  REPEAT 4 [FD :SIZE RT 90]
END
```

The variable name is always preceded by a colon. It is used in the procedure name and everywhere in the procedure that it represents a specific number. A variable name can be any letter or word that is not already a part of the Logo vocabulary. Note that FD, BK, etc. can not be used, because they are Logo primitives. SQUARE cannot be used, because it is the name of a procedure.

Procedures can have more than one variable. One example is a rectangle where the opposite sides are of different lengths. The examples below show a rectangle procedure without variables and one with variables.

```
TO RECTANGLE
FD 50 RT 90
FD 20 RT 90
FD 50 RT 90
FD 20 RT 90
END
```

```
TO RECTANGLE :S1 :S2
FD :S1 RT 90
FD :S2 RT 90
FD :S1 RT 90
FD :S2 Rt 90
END
```

Variables can also be incremented as shown below:

```
TO RECTANGLE :S
FD :S RT 90
FD :S+5 RT 90
FD :S RT 90
FD :S+5 RT 90
END
```

In this example, one side of the rectangle is always 5 steps larger than the other side.

The following procedure contains two variables-S for size and N for number of sides. By using the Rule of 360, a closed polygon is produced.

```
TO SHAPE :S :A
REPEAT A [FD :S RT 360/A]
END
```


ADDITIONAL ACTIVITIES USING SHAPES WITH VARIABLES

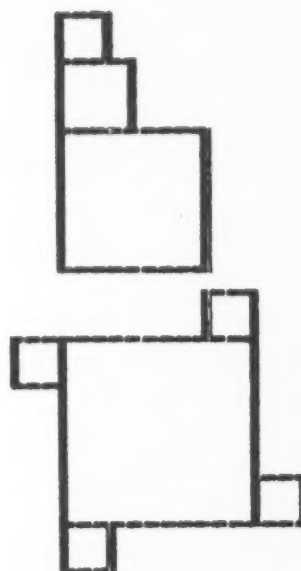
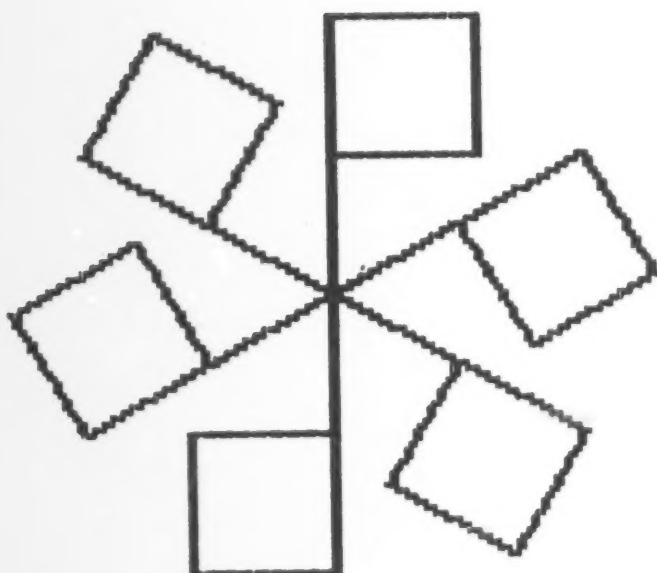
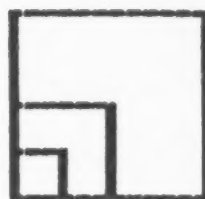
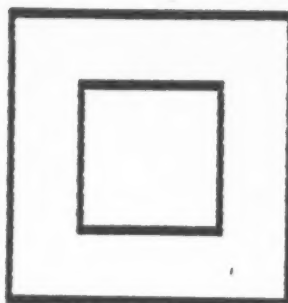
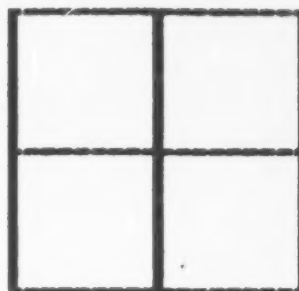
The pictures on page 23 can be used to help students develop an understanding of turtle movement and logical "turtle" thinking. Students do not need to understand variables or the TTT Theorem to use these activities. Although the ability to define procedures is not necessary, it is highly recommended, as these activities can be used to develop the idea of using procedures to create superprocedures.

You will need to provide students with a procedure for each basic shape using a variable. Explain that an input is required for the shape similar to the input required for circles. For example, SQ 40 will draw a square whose sides are 40 steps FD. Older students should be encouraged to write their own shape procedures using the worksheet on geometric shapes (page 15).

Lessons should focus on one shape at a time. (Squares are recommended for the initial lessons, as they are the easiest to work with.) When a new shape is introduced, stress the similarity between the new set of shape pictures and the previous set of shape pictures.

Many of the picture ideas shown here come from The Turtle's Sourcebook by Donna Bearden, Kathleen Martin Ph.D, and Jim Muller. This book is available through the county's Learning Resources library.

LOGO PICTURES USING GEOMETRIC SHAPES



ARCS AND CIRCLES

Procedures that draw arcs and circles of any radius are very useful although the mathematics required to write these procedures is complicated and beyond the understanding of most elementary students and Logo users who do not have a math background. The procedures for arcs and circles have been pre-defined on the Apple Logo language disk. When the Logo disk is booted, the following message appears on the screen:

PRESS THE RETURN KEY TO BEGIN.

IF YOU HAVE YOUR OWN FILE DISKETTE,

INSERT IT NOW, THEN PRESS RETURN.

Leave the language disk in the drive and press RETURN. Notice that the disk drive light goes on and off several times before the message WELCOME TO LOGO appears. It is loading the start-up file which contains the procedures for arcs and circles. You may omit this step if the start-up file has been saved on your file disk.

CIRCLER # These commands will draw circles to the
CIRCLEL # right or left with a radius of #.

CIRCLER 50 draws a circle to the right with a radius of 50.

CIRCLEL 50 draws a circle to the left with a radius of 50.

ARCR # # These commands will draw arcs to the right
ARCL # # or left with a given radius and portion.

ARCR 20 180 draws a semi-circle to the right with a radius of 20. ARCL 40 90 draws 1/4 of a circle to the left with a radius of 40.

Arcs require two inputs. The first input is the radius of the circle, and the second input is the portion of the circle. If a complete circle is 360 degrees:

1/4 circle is 90 degrees (1/4 of 360)
1/2 circle is 180 degrees (1/2 of 360)
3/4 circle is 270 degrees (3/4 of 360)

ARC WORKSHEET

The following activities are designed to help you develop a better understanding of arcs. Follow the steps below to see a demonstration of some procedures that use arcs.

1. Load the file called LOOPS.
2. Invoke the procedure called DEMO.
3. Enter one of the following names to see a demonstration of that procedure:

SCALLOP

POLES

SKINNY.POLES

BUTTERFLY

STAGGERED.POLES

ROLLS

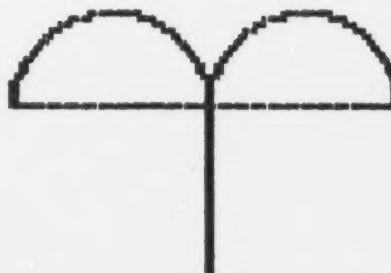
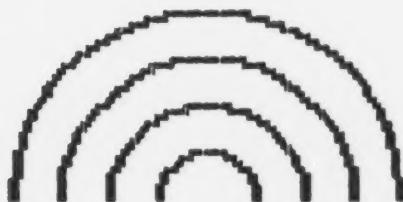
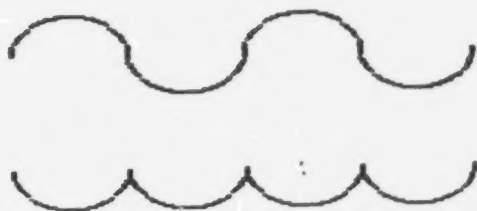
FLOWER

HOT.DOG

LACE

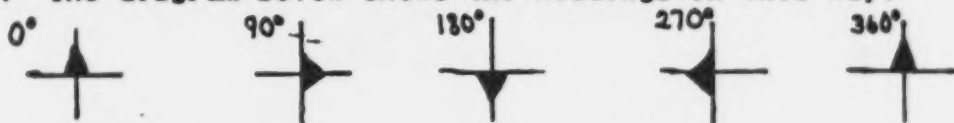
Type STOP to end DEMO and return to Logo.

4. Try creating your own arc procedures for the pictures below. DO NOT use any of the names listed above for your procedures.



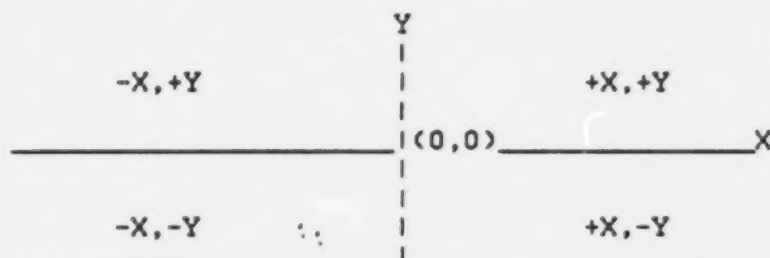
TURTLE HEADING AND POSITION

HEADING refers to the direction the turtle is pointing. Since the Logo turtle is geometric, the heading can range from 0 to 360 degrees. Heading can be compared to a compass rose on a map. The diagram below shows the headings in this way.



PRINT HEADING (PR HEADING) shows the turtle's current heading. SETHEADING (SETH) turns the turtle to a heading between 0 and 360.

POSITION refers to the screen location of the turtle. The turtle "lives" in the Cartesian plane (an x-y coordinate system where 0,0 is located at the center). The X values range from -140 to 135. The Y values range from 109 to -120.



PRINT POSITION (PR POS) displays the turtle's position in an (x,y) manner. For example, -130. 100. is near the upper left corner while, 130. -100. is near the lower right corner.

PRINT YCOR prints the y-coordinate, and PRINT XCOR prints the x-coordinate.

SETPOS [] sets the turtle to a specific position. DO NOT USE A COMMA BETWEEN THE NUMBERS.

SETY sets the y-coordinate, and SETX sets the x-coordinate.

HEADING AND POSITION WORKSHEET

Tommy Turtle decided to play a trick on his teacher. He bragged that his turtle was magic and could draw certain "invisible" square procedures. He challenged his teacher to try various size squares. It was true, his turtle drew procedures that were not listed when he typed POTS. Tommy informed the teacher that he would reveal his secret and the "invisible" procedures on one condition: The teacher had to figure out why the squares looked so strange. Knowing that Tommy is one of those "gifted" turtles who loves to challenge the teacher, the teacher accepted his deal. The teacher recalled that the squares appeared at random locations and headings on the screen. After explaining the commands PR HEADING and PR POSITION to the rest of the class, the teacher proceeded to solve the mystery.

1. Load the file PAPER.DOLL. Type POTS and notice the procedures that are listed.

2. Determine the turtle's heading or position for each of the "invisible" procedures listed below:

- | | |
|--------------|--------------|
| a. SQ1 _____ | d. SQ4 _____ |
| b. SQ2 _____ | e. SQ5 _____ |
| c. SQ3 _____ | |

3. To see Tommy's "invisible" procedures, type UNBURY "SQUARES <RETURN>. Now type POTS.

TOMMY'S SECRET: Tommy hid the procedures by using several commands. First he packaged the procedures by typing PACKAGE "SQUARES [SQ1 SQ2 SQ3 SQ4 SQ5]. Then he buried the procedures in the workspace by typing BURY "SQUARES. NOTE: Procedures must be packaged before they can be buried.

The following activities use the SETH #, SET POS [# #], SETX # and SETY # and the procedures in the file PAPER.DOLL.

1. Use RECTANGLE to place a blue rectangle in the upper left and lower right portions of the screen.
2. Use PERSON and SETH # to draw the person upside down.
3. Invoke the procedure PAPER.DOLLS then type PO "PAPER.DOLLS. Notice that it places paper dolls at various positions on the x-coordinate 0. Write a procedure that places a row of paper dolls at the x-coordinates 40 and -40.
4. Write a procedure that places a PERSON in each corner of the screen. Use SETH to make each person "stand" in a different direction.
5. Using the graph paper on page 29, create a procedure to draw a picture using only the heading and position commands.

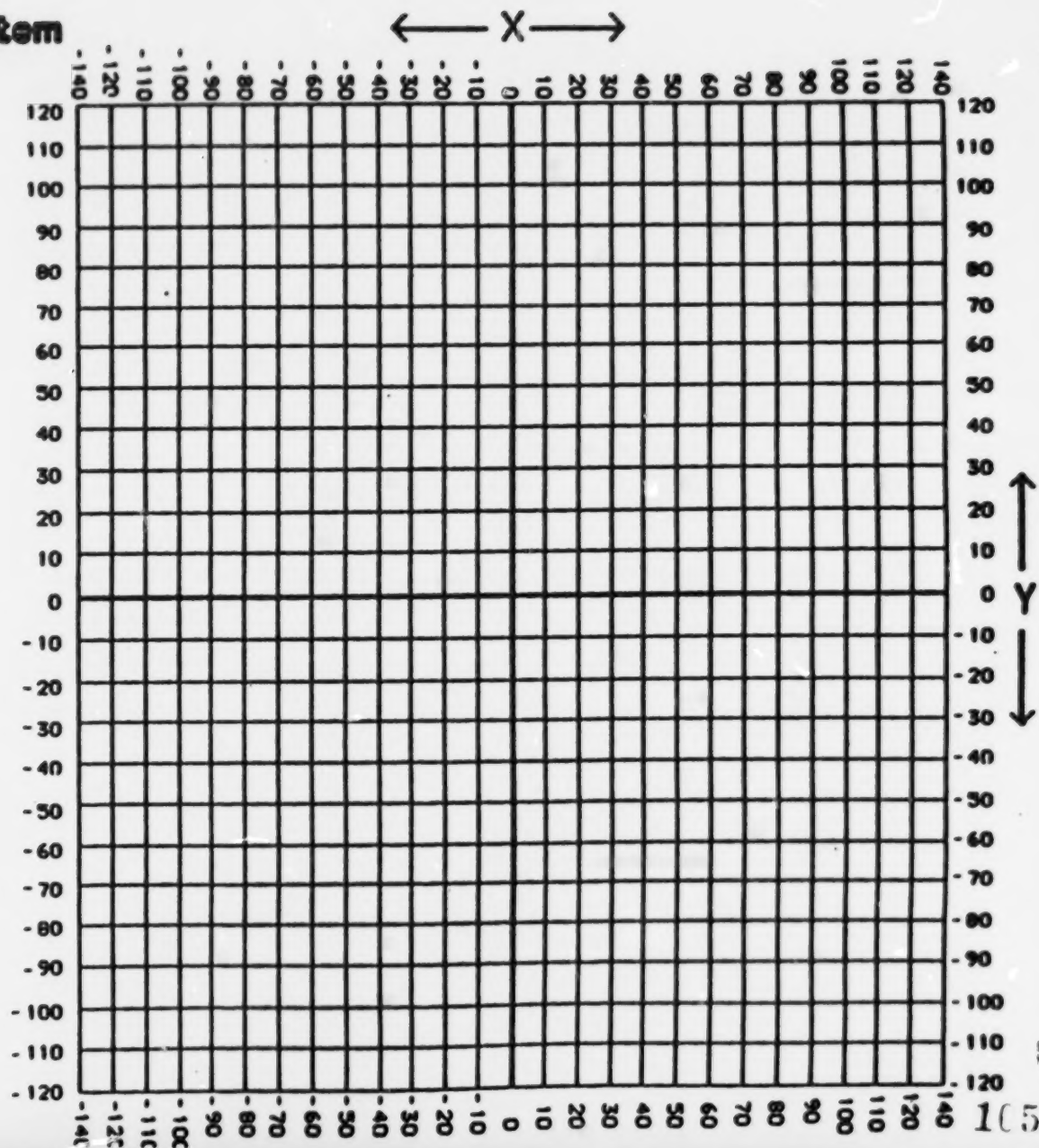
Cartesian Coordinate System

```
SETPOS [ xcor ycor ]
SETPOS [ -60 90 ]
```

```
DOT [ xcor ycor ]
DOT [ 130 120 ]
```

```
SETX xcor   SETY ycor
SETX 100    SETY -75
```

```
PRINT POS
PRINT XCOR
PRINT YCOR
```



RECURSION

Recursion is a powerful concept that is best understood by observation and experimentation. It relies on Logo's ability to call on a procedure from within a procedure. For example, the procedure YARD calls on the procedure CAT. Logo begins YARD, "leaves" YARD to perform CAT and "returns" to complete YARD. In recursion, Logo uses a procedure within itself. For example, BOX is a command within the procedure BOX. In this case, Logo begins BOX, "leaves" BOX to perform BOX and "returns" to complete BOX.

Recursion can be stopped by using CTRL-G to interrupt the procedure, or it can be controlled by using an IF-THEN statement to stop the procedure as shown in the example below.

```
TO SQUARE :S
IF :S > 100 STOP
REPEAT 4 [FD :S RT 90]
SQUARE :S+4
END
```

When S reaches a value > 100,
the procedure will stop
automatically.

The example above is "tail-end" recursion because the recursive line (SQUARE :S+4) occurs at the end of the procedure.

"Embedded" recursion is so named because the recursive line is in the middle of the procedure. In embedded recursion, Logo works through the procedure to the end, starts there and works back to the beginning. Compare the two examples below.

Tail-end Recursion

```
TO NUMBER :X
IF :X > 5 STOP
PRINT :X
NUMBER :X+1
END
```

Here, NUMBER 1 would print 1,2,3,4,5 because PRINT is before the recursive line.

Embedded Recursion

```
TO NUMBER :X
IF :X > 5 STOP
NUMBER :X+1
PRINT :X
END
```

Here, NUMBER 1 would print 5,4,3,2,1 because PRINT is after the recursive line.

RECURSION WORKSHEET

Load the file RECURSION. Experiment with the procedures in the file noting carefully the output of each procedure and how the output changes when different variables are used. The procedures SPIRAL, BOX and BOX2 require only one input. The procedures POLYSPIRAL and POLYSPIRAL2 require two inputs: the first is the distance forward, and the second is the angle.

1. Invoke SPIRAL. Use Control-G to stop the procedure. Try again using a larger or smaller input. What is the effect?

2. Compare BOX and BOX2 by answering the questions below.
Does the procedure get larger or smaller as it is drawn?

BOX

BOX2

Does a smaller variable change the picture?

BOX

BOX2

Try a variable > 100. What is the effect?

BOX

BOX

3. Type PO "BOX <RETURN> and PO "BOX2 <RETURN>. Compare the two procedures. Notice that BOX is tail-end recursion while BOX2 is embedded recursion. Make new procedures similar to BOX and BOX2. Change the RT 90 to another number. Change N+5 to N+ another number. How do these changes effect the output?

4. Use the chart below to record the effect of various inputs on POLYSPIRAL and POLYSPIRAL2.

	Draw in or out?	Sketch the output
POLYSPIRAL 30 90		
POLYSPIRAL 90 90		
POLYSPIRAL 30 120		
POLYSPIRAL 90 120		
POLYSPIRAL 30 60		
POLYSPIRAL 90 60		
POLYSPIRAL ____		
POLYSPRIAL ____		
POLYSPIRAL2 30 90		
POLYSPIRAL2 90 90		
POLYSPIRAL2 30 120		
POLYSPIRAL2 90 120		
POLYSPIRAL2 30 60		
POLYSPIRAL2 90 60		
POLYSPIRAL2 ____		
POLYSPIRAL2 ____		

Type PO "POLYSPIRAL <RETURN> and PO "POLYSPIRAL2 <RETURN>.

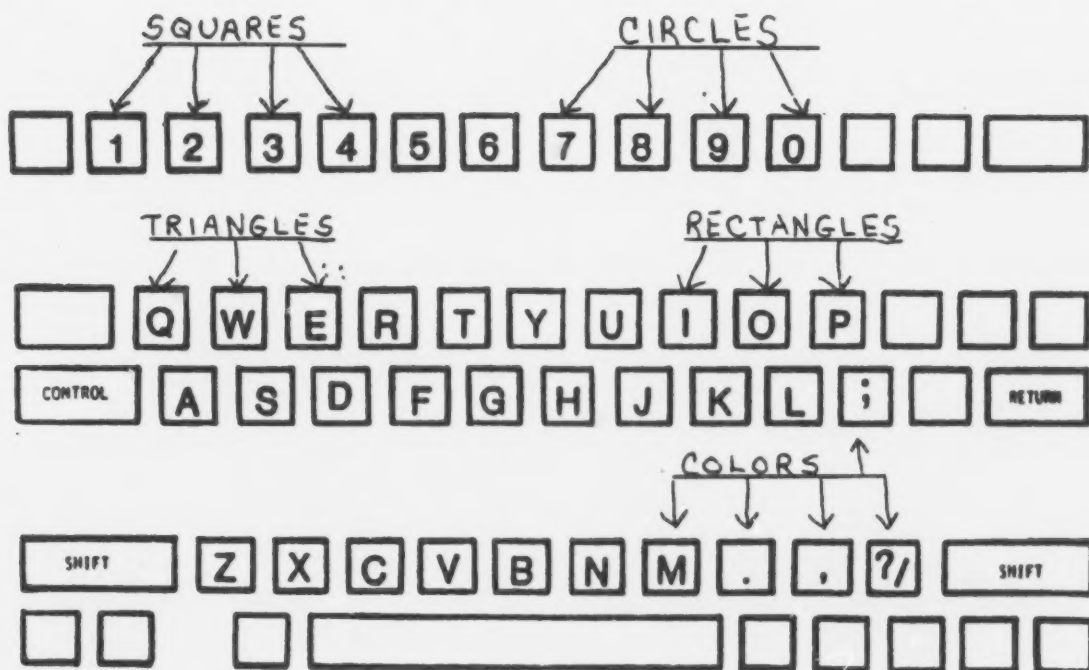
Compare the two procedures. Notice that POLYSPIRAL decreases the input, while POLYSPIRAL2 increases the input. Notice that the conditional statement is also different.

5. Create a recursive procedure using a conditional IF statement that stops the procedure when the variable reaches 60.

E-2 LOGO COMMANDS

KEYBOARD DIAGRAM OF SHAPE AND COLOR LOCATIONS

F	FORWARD	<u>SHAPES</u>		RECTANGLES
B	BACK	SQUARES	CIRCLES	I 
R	RIGHT			O 
L	LEFT			P 
C	CLEARSCREEN	1 	7 	TRIANGLES
:	WHITE			Q 
M	ORANGE	2 	8 	W 
.	PURPLE			E 
.	GREEN			
/	BLUE	3 	9 	
H	HIDETURTLE			
T	(shows) TURTLE	4 	0 	
U	UP (PENUP)			
D	DOWN (PENDOWN)			
X	ERASE (PENERASE)			
-				



E-Z LOGO WORKSPACE AND DISK COMMANDS

In Logo, workspace refers to a space in the computer's memory where procedures are stored temporarily. A set of commands becomes a "procedure" when it is "saved" in the workspace. The workspace commands listed below are only accessible through E-Z Logo 2.

SAVE-To save a set of commands, press "S". When SAVE PROCEDURE appears, type a name for the procedure and press RETURN. The commands now become a procedure, the screen is cleared and a new procedure can be started.

GET-To recall or GET a procedure, press "G". When GET PROCEDURE appears, type the name of a procedure that has been "saved" and press RETURN. The turtle performs all the commands entered for that procedure. Press "C" if you wish to clear the screen.

NAME-To see the NAMES of the procedures in the workspace, press "N".

ZAP-To erase or ZAP a procedure from the workspace, press "Z". When ZAP WHAT PROCEDURE appears, type the name of the procedure you wish to erase and press RETURN.

NOTE: Procedures in the workspace must be saved to the disk BEFORE RETURNING TO THE MAIN MENU OR BEFORE THE POWER IS SHUT OFF; otherwise, they will be erased. (See explanation below.)

E-Z LOGO DISK COMMANDS

E-Z Logo disk commands allow the user to save procedures on the disk and recall those procedures at a later date. The procedures are saved directly on the E-Z Logo disk as a file. A file consists of one or more procedures.

HOW TO ACCESS THE DISK COMMANDS: Boot the E-Z Logo disk and choose option 2 (E-Z Logo 2). When the turtle appears, press CONTROL-D (for disk commands). Below is an explanation of the options on the menu.

LOAD-This command places a "copy" of the procedures in a file into the computer's memory or workspace.

SAVE-This command "saves" ALL procedures that are currently in the workspace. **NOTE:** If two or more files were loaded into the memory, they will become one file when they are saved.

ERASE-This command erases a file PERMANENTLY from the disk.

CATALOG-This command lists the files stored on a disk.

RETURN TO E-Z LOGO 2-This command is used to return to E-Z Logo 2 after a file has been loaded or saved.

LOGO WORKSPACE COMMANDS

The workspace in Logo refers to a space in the computer's memory where commands are stored temporarily. Below is a list of the Apple Logo workspace commands and an explanation of each one.

TO SEE A PROCEDURE-type the name of the procedure and press RETURN.

POTS-(Print Out TitleS) will list the procedures in the workspace (similar to "NAME" in E-Z Logo).

POPS-(Print Out ProcedureS) will list each procedure in the workspace with its commands .

PQ "name-(Print Out "name) will list a specific procedure and its commands.

ER "name-(ERase "name) will erase a procedure from the workspace (similar "ZAP" in E-Z Logo).

ERALL-(ERase ALL procedures) will clear all procedures from the workspace.

LOGO FILE (DISK) COMMANDS

Logo files differ from E-Z Logo files in two ways: Logo files are saved on a separate data disk and file commands are entered directly from the keyboard, not through a menu. Below is a list of the Apple Logo file commands.

CATALOG lists all the files on the disk including files that are not Logo. The file names followed by .LOGO show which files are Logo files.

SAVE "<file name> will save all the procedures that are in the workspace.

LOAD "<file name> loads a file from the disk into the workspace. NOTE: Do not include .LOGO as part of the file name. If there are any procedures in the workspace, they will merge with the file that is loaded.

ERASEFILE "<file name> is used in two ways. It will remove a file from the disk (similar to DELETE FILE in E-Z Logo). It is also used in conjunction with the SAVE command as shown in step 2 on the next page.

SAVING LOGO FILES TO THE DISK: If a file name exists on the disk, the file in the workspace can not be saved using the same name. If the file in the workspace has been changed and you wish to save the file, use one of the following procedures:

1. Save the file using a different name. This can become confusing if the same file is used frequently and wastes space on the disk if it is done too often.
2. Save the file using the same name in this manner:
 - a. Type ERASEFILE "<file name>" and press RETURN. The disk light will come on while the file is being erased from the disk.
 - b. Type SAVE "<file name>" and press RETURN.
 - c. When the message _____ PROCEDURES SAVED appears, you may power down.
3. Type UPDATE "<file name>" and press RETURN. NOTE: The data disks used in this workshop were altered to allow the use of this command. The following procedure was added to the startup file of these data disks.


```

      TO UPDATE: NAME
      ERASEFILE: NAME
      SAVE: NAME
      END
      
```

If you make a new data disk, you will need to add this procedure to the start-up file. Directions for making data disks can be found on pages 143-147 of the Apple Logo Introduction to Programming through Turtle Graphics Manual. Add UPDATE to the start-up file using the steps listed below:

1. Create the procedure UPDATE as shown above.
2. Type PACKAGE "UPDATE [UPDATE] and press RETURN.
3. Type BURY "UPDATE and press RETURN.
4. Type ERASEFILE "STARTUP and press RETURN.
5. Type SAVE "STARTUP [AIDS UPDATE] and press RETURN.

ADDITIONAL RESOURCES

Beardin, Donna, Kathleen Martin, PhD, and Jim Muller, Young People's Logo Association. A practical guide to learning and teaching Logo: The Turtle's Sourcebook. Reston, VA: Reston Publishing Company, Inc. A Prentice-Hall Company, 1983.

Billstein, Rick, Shlomo Libeskind and Johnny W. Lott. Apple Logo Programming and Problem Solving. Missoula, MT: The Benjamin/Cummings Publishing Company, Inc., 1986.

Papert, Seymour. Mindstorms, Children, Computers, and Powerful Ideas. New York: Basic Books, Inc. 1980.

Shimabukuro, Gini. Thinking in Logo A Sourcebook for Teachers of Primary Students. Menlo Park, CA: Addison-Wesley, 1988.

Thornburg, David D. Beyond Turtle Graphics Further Explorations of Logo. Menlo Park, CA: Addison-Wesley, 1986.

Thornburg, David D. Discovering Apple Logo An Invitation to the Art and Pattern of Nature. Reading, MA.: Addison-Wesley, 1983.

Watt, Daniel and Molly Watt. Teaching with Logo Building Blocks for Learning. Menlo Park, CA: Addison-Wesley, 1986.

APPENDIX I

PROGRAM LISTINGS AND DOCUMENTATION

The files on the Logo Workshop Data Disk were written by this author and were used in conjunction with the workshops and the study guide. A brief summary of how each file was used precedes the listing for the procedures in that file. To access the files, load Apple Logo. When the following message appears on the screen:

PRESS THE RETURN KEY TO BEGIN
IF YOU HAVE YOUR OWN FILE DISKETTE,
INSERT IT NOW, THEN PRESS RETURN.

insert the data disk. The command CATALOG will show a list of the files on the disk. To access a file, type LOAD " name of file and press RETURN. The command POTS will show a list of the procedures in the file. To access a specific procedure, type the name of the procedure and press RETURN. To see the contents of a specific procedure, type PO "<name of procedure>. Type ERALL to clear the memory before loading a new file.

INTRO.PICTURES

This file was used to create the pictures on p. 12 of the study guide (Appendix H:65). These pictures were used with the lesson Introduction to Apple Logo (Appendix J:87). The procedures WORK.SHEET and WKST2 create a screen display of the various procedures which was printed using a Fingerprint interface card. The graphics were then transferred to the study guide.

TO WORK.SHEET

```
HT PU SETPOS [-75 75] PD BUGYES
PU SETPOS [50 75] PD BARBELL
PU SETPOS [70 35] PD SETH 0 SPRING
PU SETPOS [-100 -20] PD SETH 0 TREE
PU SETPOS [0 -30] SETH 0 PD SNOWMAN
END
```

TO BUGYES

```
CIRCLER 10 CIRCLER 20 CIRCLER 30
CIRCLEL 10 CIRCLEL 20 CIRCLEL 30
END
```

TO BARBELL

```
CIRCLEL 20 RT 90 FD 40
LT 90 CIRCLER 20
END
```

TO SPRING

```
RT 90
REPEAT 3 [CIRCLER 15 FD 10]
END
```

TO TREE

```
RT 90 CIRCLEL 20
RT 90 FD 30
END
```

TO SNOWMAN

```
RT 90 CIRCLER 40 CIRCLEL 25
END
```

TO WKST2

```
PU SETPOS [-100 50] PD SETH 0 CHAIR
PU SETPOS [-50 50] PD SETH 0 FLAG
PU SETPOS [50 70] PD SETH 0 DIAMOND
PU SETPOS [-80 -70] PD SETH 0 ZIG
PU SETPOS [-30 -50] PD SETH 0 STEPS
PU SETPOS [60 -70] PD SETH 0 DOTTED
END
```

```

TO CHAIR
FD 40 BK 20 RT 90
FD 20 RT 90 FD 20
END

```

```

TO FLAG
REPEAT 4 [FD 40 RT 90]
REPEAT 4 [FD 20 RT 90]
END

```

```

TO DIAMOND
RT 30 REPEAT 2 [FD 40 RT 120 FD 40 RT 60]
END

```

```

TO ZIG
RT 30 REPEAT 3 [FD 30 LT 120 FD 30 RT 120]
END

```

```

TO STEPS
REPEAT 3 [FD 20 RT 90 FD 20 LT 90]
END

```

```

TO DOTTED
REPEAT 3 [FD 15 PU FD 15 PD]
END

```

SHAPES

The procedures in this file were used in conjunction with lessons titled The Repeat Command (Appendix J:89) and Writing Logo Procedures (Appendix J:91).

```

TO SQ25
REPEAT 4 [FD 25 RT 90]
END

```

```

TO TRI25
REPEAT 3 [FD 25 RT 120]
END

```

```

TO SQ50
REPEAT 4 [FD 50 RT 90]
END

```

```

TO TRI50
REPEAT 3 [FD 50 RT 120]
END

```

```

TO SQ75
REPEAT 4 [FD 75 RT 90]
END

```

```

TO TRI75
REPEAT 3 [FD 75 RT 120]
END

```

```

TO REC20
REPEAT 2 [FD 40 RT 90 FD 20 RT 90]
END

```

```

TO REC35
REPEAT 2 [FD 70 RT 90 FD 35 RT 90]
END

```

```

TO REC50
REPEAT 2 [FD 100 RT 90 FD 50 RT 90]
END

```

MISTAKES

The file MISTAKES was used for the editing lesson (Appendix J:93). These procedures, except PARK, contain various errors. The correct listings for these procedures are in the file PARK.

```

TO PARK
HT
PU SETX 50 SETY 40 PD HOUSE
PU SETX -10 SETY 35 PD SETH 0 TREE
PU SETX -50 SETY -80 PD SETH 0 DOG
PU SETX -100 SETY 60 PD SETH 0 STOPSIGN
PU SETX 100 SETY -70 PD SETH 0 SWING
PU SETX -50 SETY -35 PD SETH 0 SEESAW
END

```

```

TO HOUSE
LT 18 PENT50
SETH 90 FD 15 SETH 0
FD 30 LT 90
FD 20 RT 90 FD 30
END

```

```

TO TREE
FD 50 RT 180
REPEAT 3 [CIRCLEL 15 LT 45]
END

```

```

TO DOG
LT 90 RECTANGLE FD 5
LT 90 SQ7 RT 90 FD 20 LT 90 SQ7
LT 90 FD 25 LT 90 FD 15 LT 90 BK 5 SQ15
FD 15 RT 90 FD 15 RT 90 TRI10
FD 15 RT 90 FD 7 CIRCLEL 30
FD 8 RT 90 FD 45 RT 45 TAIL
END

```

```

TO RECTANGLE
REPEAT 2 [FD 35 RT 90 FD 15 RT 90]
END

```

TO TAIL
 REPEAT 3 [CIRCLER 3 FD 4]
 END

TO STOPSIGN
 LT 90 HEX15
 FD 7 LT 90 FD 30
 END

TO SWING
 RT 25 FD50 RT 135 FD50 BK50
 RT 125 FD 90 LT 125
 FD 50 BK 50 RT 45 FD 50 BK 50
 LT 100 FD 50 SETH 180 FD 25 RT 90 FD20 RT 90 FD 30
 END

TO SEESAW
 LT 90 TRI15 FD 15 RT 120 FD 15 RT 45 FD 30 BK 60
 SETH 0 PU FD 20 PD PERSON
 SETH 90 PU FD 50 SETH 0 FD 20 PD PERSON
 END

TO PERSON
 RT 90 CIRCLEL 70 RT 90 FD 15
 LT 60 FD 10 BK 10 RT 120 FD 10 BK 10
 LT 60 BK 10 RT 90 FD 5 BK 10
 END

PARK

The following procedures are the corrected version
 of the file MISTAKES which is saved on the data disk as
 the file PARK.

TO PARK
 HT
 PU SETX 50 SETY 40 PD HOUSE
 PU SETX -10 SETY 35 PD SETH 0 TREE
 PU SETX -50 SETY -80 PD SETH 0 DOG
 PU SETX -100 SETY 60 PD SETH 0 STOPSIGN
 PU SETX 100 SETY -70 PD SETH 0 SWING
 PU SETX -50 SETY -35 PD SETH 0 SEESAW
 END

TO HOUSE
 LT 18 PENT50
 SETH 90 FD 15 SETH 0
 FD 30 RT 90 FD 20 RT 90 FD 30
 END

TO PENT50
 REPEAT 5 [FD 50 RT 72]
 END

TO TREE
 FD 50 RT 180
 REPEAT 5 [CIRCLEL 15 LT 45]
 END

TO DOG
 LT 90 RECTANGLE FD 5
 LT 90 SQ7 RT 90 FD 20 LT 90 SQ7
 LT 90 FD 25 LT 90 FD 15 LT 90 BK 5 SQ15
 FD 15 RT 90 FD 15 RT 90 TRI10
 FD 15 RT 90 FD 7 CIRCLEL 3
 FD 8 RT 90 FD 45 RT 45 TAIL
 END

TO RECTANGLE
 REPEAT 2 [FD 35 RT 90 FD 15 RT 90]
 END

TO SQ15
 REPEAT 4 [FD 15 RT 90]
 END

TO SQ7
 REPEAT 4 [FD 7 RT 90]
 END

TO TRI10
 REPEAT 3 [FD 10 RT 120]
 END

TO TRI15
 REPEAT 3 [FD 15 RT 120]
 END

TO TAIL
 REPEAT 3 [CIRCLEL 3 FD 4]
 END

TO HEX15
 REPEAT 6 [FD 15 RT 60]
 END

TO STOPSIGN
 LT 90 HEX15 FD 7
 LT 90 FD 30
 END

TO SWING
 RT 25 FD 50 RT 135 FD 50 BK 50
 RT 125 FD 90 LT 125
 FD 50 BK 50 RT 45 FD 50 BK 50
 LT 100 FD 50 SETH 180 FD 25 RT 90 FD 20 RT 90 FD 30
 END

TO SEESAW
 LT 90 TRI15 FD 15 RT 120 FD 15
 RT 45 FD 30 BK 60
 SETH 0 PU FD 20 PD PERSON SETH 90 PU FD 50 SETH 0 FD 20
 PD PERSON
 END

TO PERSON
 RT 90 CIRCLE 7 RT 90 FD 15 LT 60 FD 10 BK 10 RT 120
 FD 10 BK 10 LT 60 BK 10 RT 90 FD 5 BK 10
 END

PAPER.DOLL

The procedures in this file were used with the lesson Heading and Position Commands (Appendix J:99). The SQ# procedures demonstrate the use of the PR HEADING and PR POSITION commands. The remaining procedures demonstrate the use of the SETH and SET POS commands.

TO SQ1
 CS RT 115
 REPEAT 4 [FD 50 RT 90]
 END

TO SQ2
 CS LT 45
 REPEAT 4 [FD 50 RT 90]
 END

TO SQ3
 CS PU SETPOS [-75 40]
 PD SETH 0
 REPEAT 4 [FD 50 RT 90]
 END

TO SQ4
 CS PU SETPOS [60 -35]
 PD SETH 0
 REPEAT 4 [FD 50 RT 90]
 END

TO SQ5
 CS PU SETPOS [0 70] PD RT 20
 REPEAT 4 [FD 50 RT 90]
 END

TO PERSON
 HEAD LT 90 BODY
 END

TO HEAD
 LT 90 CIRCLE 15
 END

```

TO BODY
FD 40 BK 20
LT 90 FD 15 LT 90 FD 5 BK 10 FD 5 RT 90
BK 30 LT 90 FD 5 BK 10 FD 5 RT 90
FD 15 RT 90
FD 20 RT 45 FD 25 RT 45 FD 5 BK 10 FD 5 LT 45 BK 25
LT 90 FD 25 LT 45 FD 5 BK 10 FD 5 RT 45 BK 25
END

```

```

TO PAPER.DOLLS
PU SETPOS [-100 0] PD SETH 0 PERSON
PU SETPOS [-50 0] PD SETH 0 PERSON
PU SETPOS [0 0] PD SETH 0 PERSON
PU SETPOS [50 0] PD SETH 0 PERSON
PU SETPOS [100 0] PD SETH 0 PERSON
END

```

LOOPS

The file LOOPS was used with the lesson Arcs (Appendix J:97). The procedures DEMO and PICTURES demonstrate various ways to use the arc commands.

```

TO DEMO
SPLITSCREEN
PR [ENTER A COMMAND FROM THE SHEET]
PICTURES
END

```

```

TO PICTURES
MAKE "ANSWER READWORD
IF :ANSWER = "SCALLOP [CS SCALLOP]
IF :ANSWER = "BUTTERFLY [CS BUTTERFLY]
IF :ANSWER = "FLOWER [CS FLOWER]
IF :ANSWER = "POLES [CS POLES]
IF :ANSWER = "STAGGERED.POLES [CS STAGGERED.POLES]
IF :ANSWER = "HOT.DOG [CS HOT.DOG]
IF :ANSWER = "SKINNY.POLES [CS SKINNY.POLES]
IF :ANSWER = "ROLLS [CS ROLLS]
IF :ANSWER = "LACE [CS LACE]
IF :ANSWER = "STOP [CS STOP]
DEMO
END

```

TO SCALLOP

REPEAT 7 [ARCL 20 180 LT 180]

END

TO BUTTERFLY

REPEAT 4 [ARCR 35 180 RT 90]

END

TO FLOWER

PU FD 30 PD

REPEAT 4 [ARCR 35 180 LT 90]

PU BK 17 RT 90 FD 35 PD CIRCLES 20

END

TO POLES

REPEAT 7 [ARCL 20 180 FD 40 BK 40 LT 180]

END

TO STAGGERED.POLES

POLES LT 90 PU FD 15 RT 90 FD 20 PD POLES

END

TO HOT.DOG

PU FD 50 PD

REPEAT 2 [ARCL 10 180 FD 50]

PU FD 20 RT 90 FD 10 LT 90 PD

REPEAT 2 [ARCL 10 180 LT 180 ARCL 10 180 FD 90]

END

TO SKINNY.POLES

BK 40 FD 40

REPEAT 4 [ARCL 10 180 FD 40 BK 40 LT 180]

END

TO ROLLS

PU FD 30 PD

POLES

BK 80 RT 180

POLES

END

TO LACE

REPEAT 2 [SCALLOP2 30]

RT 180 FD 5

REPEAT 2 [SCALLOP2 30]

END

TO SCALLOP2 :SIZE

REPEAT 7 [ARCL :SIZE 180 LT 180]

END

VARIABLES

The procedures in this file could be used in conjunction with the lesson Variables (Appendix J:95).

```
TO PENTAGON :SIDE          TO TRIANGLE :SIDE
REPEAT 5 [FD :SIDE RT 72]  REPEAT 3 [FD :SIDE RT 120]
END                          END
```

```
TO FLOW2 :SIZE
REPEAT 6 [PENTAGON :SIZE FD 10 TRIANGLE :SIZE LT 60 FD
10]
END
```

```
TO FLOWER :SIZE
REPEAT 5 [TRIANGLE :SIZE RT 360 / 5]
END
```

```
TO FLOW :SIZE
REPEAT 12 [PENTAGON :SIZE FD 10 TRIANGLE :SIZE LT 30 FD
10]
END
```

SQUARE.PICTURES

The procedures SQUARE.DEMO accesses the procedure PICTURES to demonstrate each picture being drawn step by step. The procedure names followed by a "2" contain the WAIT command to slow the drawing process. SQUARE.DEMO could be used to illustrate the concept of using procedures within procedures. The same procedures are also listed without the WAIT command. These procedures were used to create the worksheet on p. 23 of the study guide (Appendix H:65) but could also serve as examples of using variables within procedures.

```
TO SQUARE.DEMO
SPLITSCEEN
PR [THIS DEMO CONTAINS: ROW, BOXES, TOWER,]
PR [FLAG, FRAME, INSIDE, OUTSIDE & PINWHEEL]
PR [ENTER A NAME OR 'STOP' TO END THE DEMO]
PICTURES
END
```

TO PICTURES

MAKE "ANSWER READWORD

IF :ANSWER = "ROW [CS SQ.ROW2 30]

IF :ANSWER = "BOXES [CS SQ.BOXES2 40]

IF :ANSWER = "TOWER [CS SQ.TOWER2 60]

IF :ANSWER = "INSIDE [CS IN.SQ2 60]

IF :ANSWER = "OUTSIDE [CS OUT.SQ2 60]

IF :ANSWER = "FRAME [CS SQ.FRAME2 80]

IF :ANSWER = "FLAG [CS SQ.FLAG2 50]

IF :ANSWER = "PINWHEEL [CS FULLSCREEN SQ.PINWHEEL2 50]

IF :ANSWER = "STOP [CS STOP]

SQUARE.DEMO

END

TO SQ :SIZE

REPEAT 4 [FD :SIZE RT 90]

END

TO SQ.ROW2 :SIZE

REPEAT 4 [SQ :SIZE WAIT 50 RT 90 WAIT 50 FD :SIZE

WAIT 50 LT 90 WAIT 50]

END

TO SQ.BOXES2 :SIZE

SQ :SIZE WAIT 50 BK :SIZE WAIT 50 SQ :SIZE WAIT 50 RT 90

WAIT 50 FD :SIZE WAIT 50 LT 90 WAIT 50 SQ :SIZE WAIT 50

FD :SIZE WAIT 50 SQ :SIZE

END

TO SQ.TOWER2 :SIZE

SQ :SIZE WAIT 50 FD :SIZE WAIT 50

SQ :SIZE / 2 WAIT 50 FD :SIZE / 2 WAIT 50

SQ :SIZE / 3 WAIT 50 FD :SIZE / 3

END

TO IN.SQ2 :SIZE

SQ :SIZE WAIT 50 SQ :SIZE / 2 WAIT 50 SQ :SIZE / 4

END

TO OUT.SQ2 :SIZE

SQ :SIZE WAIT 60 REPEAT 4 [FD :SIZE WAIT 60 BK :SIZE / 4

WAIT 60 LT 90 WAIT 60 SQ :SIZE / 4 WAIT 60 RT 90 WAIT 60

FD :SIZE / 4 WAIT 60 RT 90]

END

```

TO SQ.FRAME2 :SIZE
SQ :SIZE WAIT 50 PU RT 90 WAIT 50 FD :SIZE / 4 WAIT 50
LT 90 WAIT 50 FD :SIZE / 4 PD WAIT 50
SQ :SIZE / 2
END

```

```

TO SQ.FLAG2 :SIZE
FD :SIZE * 2 WAIT 50 RT 90 WAIT 50 SQ :SIZE WAIT 50
LT 90 WAIT 50 BK :SIZE * 2
END

```

```

TO SQ.PINWHEEL2 :SIZE
REPEAT 6 [SQ.FLAG2 :SIZE WAIT 50 RT 60 WAIT 50]
END

```

```

TO SQ.ROW :SIZE
REPEAT 4 [SQ :SIZE RT 90 FD :SIZE LT 90]
END

```

```

TO SQ.BOXES :SIZE
SQ :SIZE BK :SIZE SQ :SIZE RT 90 FD :SIZE LT 90 SQ :SIZE
FD :SIZE SQ :SIZE
END

```

```

TO IN.SQ :SIZE
SQ :SIZE
SQ :SIZE / 2
SQ :SIZE / 4
END

```

```

TO SQ.TOWER :SIZE
SQ :SIZE FD :SIZE
SQ :SIZE / 2 FD :SIZE / 2
SQ :SIZE / 3 FD :SIZE / 3
END

```

```

TO OUT.SQ :SIZE
SQ :SIZE REPEAT 4 [FD :SIZE BK :SIZE / 4 LT 90 SQ :SIZE
/ 4 RT 90 FD :SIZE / 4 RT 90]
END

```

```

TO SQ.FRAME :SIZE
SQ :SIZE PU RT 90 FD :SIZE / 4 LT 90 FD :SIZE / 4 PD
SQ :SIZE / 2
END

```

```

TO SQ.FLAG :SIZE
FD :SIZE * 2 RT 90 SQ :SIZE
LT 90 BK :SIZE * 2
END

```



```

TO SQ.PINWHEEL :SIZE
REPEAT 6 [SQ.FLAG :SIZE RT 60]
END

```

```

TO SQ.WINDMILL :SIZE
REPEAT 4 [SQ.FLAG :SIZE RT 90]
END

```

RECURSION

Although the concept of recursion was not taught in the workshops, the lesson Recursion is included in Appendix J:101. An explanation of recursion and related worksheets are in the study guide (Appendix H:65). The following procedures are used in conjunction with the worksheets.

```

TO SPIRAL :N
FD :N RT 90
SPIRAL :N + 5
END

```

```

TO POLYSPIRAL :N :A
IF :N < 0 [STOP]
FD :N RT :A
POLYSPIRAL :N - 1 :A
END

```

```

TO BOX :N
IF :N > 100 [STOP]
FD :N RT 90
BOX :N + 5
END

```

```

TO POLYSPIRAL2 :N :A
IF :N > 100 [STOP]
FD :N RT :A
POLYSPIRAL2 :N + 5 :A
END

```

```

TO BOX2 :N
IF :N > 100 [STOP]
BOX2 :N + 5
FD :N RT 90
END

```

APPENDIX J

LESSON PLANS FOR WORKSHOPS

E-Z LOGO DESIGN PATTERNS

OBJECTIVES:

1. The participants will locate and use the shape and color commands in E-Z Logo 2.
2. The participants will identify repeating patterns in designs.

ASSESSMENTS:

1. The participants will use the shape and color commands to produce two designs.
2. Given five designs, the participants will correctly identify the repeating pattern.

STRATEGIES:

GAIN ATTENTION: Display several designs on the large screen monitor.

INFORM LEARNER OF OBJECTIVES: Tell participants that children often create designs similar to these. Today they will learn how to create these designs by using repeating patterns.

STIMULATE RECALL: Review the single keystroke commands of E-Z Logo. Refer to study guide p. 3 which lists those commands.

PRESENT STIMULUS MATERIAL: Refer to keyboard diagram on study guide p. 3 which shows location of shape and color keys. Discuss using the organization and placement of these special keys as an aid to remembering them. Demonstrate use of the spacebar to determine the current color and turtle position.

PROVIDE LEARNING GUIDANCE: Create a design using the pattern [shape turn turn turn]. Ask participants to identify the repeating pattern. List variations of the pattern [shape turn turn] and [shape turn]. Ask participants to "predict" the design created by these patterns and test their predictions on the computer.

ELICIT PERFORMANCE: Ask participants to create the designs using the shape and color commands. Have them record the pattern used to create each design.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Observe that each participant was able to create two designs. Have participants complete number 1 on the worksheet on p. 4 of the study guide to assess objective 2.

ENHANCE RETENTION/TRANSFER: Review the keyboard location of the shape and color commands. Discuss that the number of turns in a pattern determined how many times the pattern was repeated to create a complete design. Explain that this is a very important Logo concept that will be used in future lessons.

REPEATING DESIGNS AND THE TOTAL TURTLE TRIP THEOREM

OBJECTIVE:

The participants will analyze designs and design patterns.

ASSESSMENT:

The participants will match 10 given patterns and designs correctly.

STRATEGIES:

GAIN ATTENTION: List design patterns from the previous lesson.

INFORM LEARNER OF OBJECTIVES: Tell participants that they will learn to recognize and analyze these repeating patterns in designs.

STIMULATE RECALL: Ask participants to recall that the number of turns in a pattern determined the number of times the pattern had to be repeated.

PRESENT STIMULUS MATERIAL: Explain that the E-Z Logo turtle turns 30 degrees each time "R" or "L" is pressed. Input a design using one of the patterns listed on the board. Ask participants to keep track of the number of times the pattern is repeated to create a complete design.

PROVIDE LEARNING GUIDANCE: Assist participants in calculating the number of degrees the turtle turned in the pattern. Ask participants to calculate the total number of degrees turned to create the complete pattern. Repeat this process for all three design patterns: [shape turn], [shape turn turn] and [shape turn turn turn]. Explain that turning 360 degrees is a very important Logo concept called the Total Turtle Trip (TTT) Theorem.

ELICIT PERFORMANCE: Ask participants to complete number 2 on the worksheets on pp. 4-5 of the study guide.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Observe that each participant was able to correctly match the designs on the worksheet.

ENHANCE RETENTION/TRANSFER: Review the concept of the TTT Theorem.

CREATING E-Z LOGO PROCEDURES

OBJECTIVE: The participants will use E-Z Logo 2 to create a specific picture and save it in the workspace.

ASSESSMENT: Given a worksheet containing various pictures, the participants will draw at least one picture and save it to the workspace.

STRATEGIES:

GAIN ATTENTION: Show several E-Z Logo pictures on the large screen monitor.

INFORM LEARNER OF OBJECTIVES: Tell participants they will use E-Z Logo 2 to create pictures similar to these.

STIMULATE RECALL: Review the single keystroke, shape and color commands of E-Z Logo. Refer to study guide p. 3 which lists those commands.

PRESENT STIMULUS MATERIAL: Use "G" command to get a procedure on the monitor. Ask participants to watch closely as the turtle draws it.

PROVIDE LEARNING GUIDANCE: Work an example, inputting commands suggested by participants. Have a participant record the commands on the board while you input them on the computer. Purposely make a mistake in order to demonstrate the "X" command to erase and "D" to begin drawing again. Remind participants to be aware of the turtle's location and heading when drawing. Show the "S" command to save the procedure. Get the procedure to show that all commands (even mistakes) are saved. Explain that "C" not only clears the screen but also clears the commands.

ELICIT PERFORMANCE: Ask participants to draw one of the pictures on p. 8 of the study guide and save it to the workspace. Refer participants to command list on p. 7 of the study guide.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Ask participants to use "N" command to show a list of procedure names. Observe that each participant has saved at least one picture. Ask participants to use "G" (get) command to put one of the procedures on the monitor. Observe that all participants were able to create at least one of the given pictures.

ENHANCE RETENTION/TRANSFER: Review the commands. Explain that the procedures are only saved in the workspace. Refer to p. 34 of the study guide to save files to the disk. Explain that these procedures will be used to create other pictures later.

COMBINING E-Z LOGO PROCEDURES

OBJECTIVES:

1. The participants will use E-Z Logo disk commands.
2. The participants will combine procedures to create a superprocedure.

ASSESSMENTS:

1. Observe that participants are able to load and save files to the E-Z Logo disk independently.
2. The participants will create a new procedure using two or more existing procedures.

STRATEGIES:

GAIN ATTENTION: Refer participants to p. 10 of the study guide which shows pictures created by combining several procedures.

INFORM LEARNER OF OBJECTIVES: Tell participants they will learn to use several procedures to create a larger procedure. Explain that they will be taking "parts" to form a whole picture. This process can also be used in reverse where students would "sketch out" a whole picture, break it into parts, create each part separately and finally combine the parts to form a whole picture.

STIMULATE RECALL: Review the "U" (up) command and the "G" (get) command. Recall that files were saved to the disk in the previous lesson.

PRESENT STIMULUS MATERIAL: Demonstrate loading a file. Use "N" (names) to show how the procedures in the file. Create a combined procedure together inputting commands suggested by participants. Ask for explanations of why certain commands are needed.

PROVIDE LEARNING GUIDANCE: Remind participants to be aware of the turtle's location and position when drawing pictures. Refer participants to the explanation of combining procedures on p. 9 of the study guide.

ELICIT PERFORMANCE: Ask participants to load their file from the previous lesson or the file PICTURES using the directions on p. 34 of the study guide. Ask the participants to use the procedures to make a new procedure using at least two or more of the procedures. Remind participants to save the new procedure.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Ask participants to get their new procedure on the screen. Observe that each participant was able to create a new procedure using the existing ones.

ENHANCE RETENTION/TRANSFER: Review the concept of using smaller procedures to create a larger procedure. Explain that this is an important concept in Logo. Have participants save files to the disk.

INTRODUCTION TO APPLE LOGO

OBJECTIVE: The participants will use the Apple Logo commands FD, BK, RT, LT, ST, HT, CS, PU, PD, PE, CIRCLES, CIRCLEL, SETPC and SETBG.

ASSESSMENT: Participants will use the above commands to create at least two designs or pictures.

STRATEGIES:

GAIN ATTENTION: Give participants a "diploma." Tell them they are "graduating" from E-Z Logo to Apple Logo.

INFORM LEARNER OF OBJECTIVES: Tell participants they will be learning to use Apple Logo. Stress the transition to Logo will use their knowledge of E-Z Logo -- a transition that can be used with their students.

STIMULATE RECALL: Ask participants to recall the E-Z Logo commands (F,B,R,L,T,H,C,U,D and X).

PRESENT STIMULUS MATERIAL: Compare those commands to the Apple Logo commands listed on p. 11 of the study guide. Show the color commands SETPC and SETBG and the circle commands CIRCLES and CIRCLEL.

PROVIDE LEARNING GUIDANCE: Demonstrate the commands showing the turtle's response if space or input is omitted from a command (i.e. FD20 and RT). Show CTRL-L, CTRL-S and CTRL-T commands for fullscreen, splitscreen and text screen.

ELICIT PERFORMANCE: Refer participants to worksheet on study guide p. 12.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Observe that participants were able to use the commands to create at least two designs or pictures.

ENHANCE RETENTION/TRANSFER: Tell participants they will be using these commands and learning new commands that will allow them to save their work.

THE REPEAT COMMAND

OBJECTIVE:

The participants will be able to use the REPEAT command.

ASSESSMENT: The participants will create repeating patterns using the REPEAT command.

STRATEGIES:

GAIN ATTENTION: Show a design pattern from the lesson E-Z Logo Repeating Design Patterns. List the commands to draw that design. Do not use the REPEAT command so the list will be lengthy. Discuss that entering these commands each time we use Logo is time consuming.

INFORM LEARNER OF OBJECTIVES: Tell participants they will learn how to shorten command lists using the REPEAT command.

STIMULATE RECALL: Ask participants to identify the pattern and number of repeats for the listing shown. Ask participants to recall the Total Turtle Trip (TTT) Theorem and stress that this is important in today's lesson.

PRESENT STIMULUS MATERIAL: Show how the REPEAT command will shorten the command list on the board. Ask participants to suggest variations by changing the number of repeats and the angle. Recall how these changes effected design patterns in previous lessons.

PROVIDE LEARNING GUIDANCE: Assist participants in loading the file SHAPES, which contains procedures for squares and triangles. Explain how to get these shapes. (SQ# and TRI# where # is the size of the shape.) Create a design together using the REPEAT command.

ELICIT PERFORMANCE: Ask participants to complete the activities on p. 14 of the study guide.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Observe that participants were able to use the REPEAT command for at least one picture on the worksheet.

ENHANCE RETENTION/TRANSFER: Review the REPEAT command and the relationship to the TTT Theorem. Refer participants to additional activities on p. 15 of the study guide.

WRITING LOGO PROCEDURES

OBJECTIVE:

The participants will be able to write Logo procedures.

ASSESSMENT: The participants will write a Logo procedure containing the REPEAT command.

STRATEGIES:

GAIN ATTENTION: Load the file SHAPES from the sample program disk prior to the lesson. Display a repeating design pattern. Discuss that entering commands each time we use Logo is time consuming.

INFORM LEARNER OF OBJECTIVES: Tell participants they will learn how to write procedures to save commands to the workspace.

STIMULATE RECALL: Ask participants to recall the steps for creating procedures in E-Z Logo 2. Recall that "S" was used to save procedures in E-Z Logo after the commands were entered. Explain that Logo procedures are named before the directions are given.

PRESENT STIMULUS MATERIAL: List the procedures in the file SHAPES. Ask participants to suggest commands for a repeating design using these procedures. List the commands on the board. Add the commands needed to make a procedure, explaining each one as it is added: TO (name) tells the turtle you will teach it to do something, the cursor changes and the turtle becomes inactive, END tells the turtle that you have ended the instructions and the turtle responds with (name) DEFINED to let you know that a new command was learned. Explain that we type the (name) to GET the procedure.

PROVIDE LEARNING GUIDANCE: Assist participants in loading the file SHAPES from the sample programs disk. Enter the procedure on the board together. Remind participants that they should not be concerned about typing errors; they should just finish the procedure. Explain that they will learn to edit in the next lesson. Today the instructor will edit for them and will explain each step.

ELICIT PERFORMANCE: Ask participants to complete the activities on p. 17 of the study guide.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Recall E-Z Logo workspace command "N" (name). Refer to Logo workspace commands on p. 35 of the study guide. Ask participants to type POTS and POPS. Observe that they were able to create a Logo procedure using the REPEAT command.

ENHANCE RETENTION/TRANSFER: Review the steps for writing procedures. Explain that writing procedures will help them save time. Recall E-Z Logo file commands (CTRL-D and menu options). Relate this to Logo disk management commands. Refer participants to p. 36 of the study guide for instructions on saving files to the disk.

EDITING PROCEDURES

OBJECTIVES:

1. The participants will edit Logo procedures.
2. The participants will use the REPEAT command to create the following shapes: square, triangle, pentagon and hexagon.

ASSESSMENTS: The participants will use edit commands to change and/or correct eight given procedures. The changes/corrections will include using REPEAT to create the above shapes.

STRATEGIES:

GAIN ATTENTION: Load a corrected version of the file MISTAKES from the instructor's sample programs disk. Invoke the procedure PARK. Tell participants that Tabitha Turtle tried to make a procedure for this park but she made several mistakes in her procedures.

INFORM LEARNER OF OBJECTIVES: Tell participants they will learn to edit procedures and draw shapes using the REPEAT command as they correct Tabitha Turtle's incorrect procedures.

STIMULATE RECALL: Recall the TTT Theorem and the REPEAT command from the previous lesson. Stress the importance of 360 degrees. Recall that E-Z Logo provided no means of changing procedures other than "Z" (zap).

PRESENT STIMULUS MATERIAL: Invoke the incorrect version of the procedure HOUSE. Refer participants to the editing worksheet on p. 19 of the study guide.

PROVIDE LEARNING GUIDANCE: Explain the error messages and demonstrate the editing commands for this procedure.

ELICIT PERFORMANCE: Have participants load the file "Mistakes" and complete the editing worksheet to change/correct the procedures in that file. Refer to study guide p. 18 for the editing commands.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Ask participants to invoke the procedure PARK. If the procedures were edited correctly, the picture will be correct.

ENHANCE RETENTION/TRANSFER: Have participants save the file as PARK. Review the editing commands. Explain that these commands will be useful in future lessons.

VARIABLES

OBJECTIVE: The participants will write procedures using variables.

ASSESSMENT: The participants will add variables to existing shape procedures.

STRATEGIES:

GAIN ATTENTION: Show three procedures to draw different sized squares. Discuss that writing a different procedure for each square is time-consuming and takes up unnecessary space.

INFORM LEARNER OF OBJECTIVES: Tell participants that they will learn to use variables to create more flexible procedures.

STIMULATE RECALL: Ask participants to recall that a variable is something that can change. Give examples of a math equation such as $x+y=6$.

PRESENT STIMULUS MATERIAL: Ask what is changing in the three square procedures. Elicit response of FD #. Explain that we can use a variable (a letter or a name) in place of the #. When we do this the procedure requires an input # just like FD or RT.

PROVIDE LEARNING GUIDANCE: Show participants how to change a square procedure containing a specific input to a procedure containing a variable input.

ELICIT PERFORMANCE: Have participants use the worksheet on p. 15 of the study guide to create several shape procedures using variables. Suggest that participants create procedures for the pictures shown on p. 23 of the study guide. Challenge participants to create a procedure that will draw a rectangle of any size.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Observe that participants were able to create shape procedures using variables.

ENHANCE RETENTION/TRANSFER: Explain that using variables will be useful when they are creating larger, more complex programs.

ARCS

OBJECTIVE: The participants will be able to use the ARCR and ARCL commands.

ASSESSMENT: The participants will create three procedures using the arc commands.

STRATEGIES:

GAIN ATTENTION: Show several designs using arcs.

INFORM LEARNER OF OBJECTIVES: Tell participants that they will learn to use the ARC commands to draw parts of circles.

STIMULATE RECALL: Ask participants to recall that 360 degrees make a circle. Ask how many degrees in 1/2 circle and 1/4 circle.

PRESENT STIMULUS MATERIAL: Explain that ARCR and ARCL allow us to draw a portion of a circle. These commands require the input of two variables. The first number tells the size of the circle, and the second number tells the portion of the circle.

PROVIDE LEARNING GUIDANCE: Ask participants to suggest a command that will draw 1/2 circle. Demonstrate this command using various size circles. Demonstrate ARCR and ARCL. Have participants load the file LOOPS from the sample programs disk. Explain how to use the procedure DEMO which shows procedures using the arc commands.

ELICIT PERFORMANCE: Ask participants complete the arc activities on p. 25 of the study guide.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Observe that participants were able to create procedures using arc commands.

ENHANCE RETENTION/TRANSFER: Review arc commands.
Explain that arcs can be used to teach about circles and
to create many interesting procedures.

HEADING AND POSITION COMMANDS

OBJECTIVE: The participants will be able to use screen location commands to determine and set the turtle's position and heading.

ASSESSMENTS:

1. Given a set of five procedures, the participants will use the PR HEADING and PR POS commands to determine the turtle's heading and location.
2. Given a set of four activities, the participants will use the SETH and SETPOS (or SETX and SETY) commands to complete the activities.

STRATEGIES:

GAIN ATTENTION: Prior to lesson, position turtle to SETH 3. Ask participants what will happen if FD 5000 is entered. Enter the command and discuss results. Position turtle to SETH 118. Ask how much the turtle needs to turn to be pointing straight down.

INFORM LEARNER OF OBJECTIVES: Tell participants that they will learn heading and location commands that will help them determine and set the turtle to specific headings and locations.

STIMULATE RECALL: Ask participants to recall compass headings and x-y coordinate grids.

PRESENT STIMULUS MATERIAL: Explain that the turtle's heading is like a compass heading. Demonstrate SETH 0, 90, 180, 270 and 360. Explain that the turtle's position is like the x-y coordinate system. Demonstrate SETPOS, SETX and SETY commands.

PROVIDE LEARNING GUIDANCE: Refer participants to p. 26 of the study guide which show the turtle headings and the screen locations. Enter several headings and positions to demonstrate the use of PR HEADING and PR POS.

ELICIT PERFORMANCE: Have participants load the file PAPER.DOLLS from the sample programs disk and complete the worksheets on pp. 27-28 of the study guide to become familiar with these commands.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: Observe that participants were able to successfully complete the activities on the worksheet.

ENHANCE RETENTION/TRANSFER: Review the heading and position commands. Explain that these commands will be useful in helping students "debug" or fix procedures in Logo.

RECURSION

OBJECTIVES:

1. The participants will use recursion within a procedure.
2. The participants will use a conditional statement to control recursion.

ASSESSMENT: The participants will write a procedure that uses a conditional statement to control recursion.

STRATEGIES:

GAIN ATTENTION: Show a recursive procedure in which the turtle repeats the same directions (i.e. SQUARE :N
REPEAT 4 [FD :N RT 90] CS SQUARE :N)

INFORM LEARNER OF OBJECTIVES: Explain that today's lesson will teach one of Logo's "powerful ideas" called recursion. Tell participants that they will learn ways to control the continuous repeating caused by recursion.

STIMULATE RECALL: Ask participants to recall that once a procedure is named, it can be used in other procedures.

PRESENT STIMULUS MATERIAL: Show the listing for the procedure used at the beginning of the lesson. Follow the flow of the program step-by-step. Demonstrate that this procedure can be stopped by using the command CTRL-G. Add N+4 to the last line of the procedure to show incrementing the variable. Show that the procedure is still not "controlled".

PROVIDE LEARNING GUIDANCE: Ask participants to recall if-then statements such as: IF it is raining, THEN we can not play outdoors. Generate several other examples together. Explain that if-then statements can be used in Logo to help control recursion. Add the conditional IF :N > 60 [STOP]. Demonstrate how this line controls the recursion in the procedure.

ELICIT PERFORMANCE: Have participants load the file **RECURSION** from the sample programs disk and complete the activities on study guide pp. 31-32. Explain that these activities will help them understand recursion and conditionals.

PROVIDE FEEDBACK: Assist by using "Guided Discovery" techniques. Encourage verbalizing and sharing ideas and solutions.

ASSESS PERFORMANCE: The last recursion activity is designed to assess the performance.

ENHANCE RETENTION/TRANSFER: Review the concepts of recursion and conditionals. Explain that recursion is one of Logo's "powerful ideas" that can be controlled with the use of conditionals.

APPENDIX K

POST-IMPLEMENTATION SURVEY AND RESULTS

1. Do you think you have adequate knowledge to teach Logo/E-Z Logo to your students?

Yes 100% No 0%

2. Do you think you have adequate materials and ideas to teach Logo/E-Z Logo to your students?

Yes 100% No 0%

3. Do you think that your lack of knowledge of Logo/E-Z Logo, discourages you from using it with your students?

Yes 0% No 100%

4. Would you allow or encourage gifted students to use Logo during a computer lab session?

Yes 100% No 0%

5. Would you allow or encourage gifted students to use Logo when the computer is in your classroom?

Yes 100% No 0%

APPENDIX L

SUMMARY OF THE EVALUATIONS OF STUDY GUIDE

1. Is the study guide organized and easy to use?

Yes 100% No 0% N/A 0%

Comments: Place E-Z Logo commands at the beginning of the guide; place editing commands with workspace and disk commands; punch holes so guide can be placed in a 3-ring binder.

2. Does the study guide require extensive training to use?

Yes 0% No 100% N/A 0%

Comments: A basic background knowledge of the computer is necessary and some training is needed.

3. Can the guide be used by teachers without prior training?

Yes 37% No 63% N/A 0%

Comments: Some teachers will not be able to follow the guide. (This depends on the teacher's prior knowledge.)

4. Is the guide appropriate for students to use?

Yes 50% No 50% N/A 0%

Comments: The guide is appropriate for older students.

5. Does the guide provide direct instruction?

Yes 100% No 0% N/A 0%

Comments:

6. Does the guide provide sufficient ideas and suggestions for implementing Logo into the curriculum?

Yes 100% No 0% N/A 0%

Comments:

7. Does the guide provide a glossary of terminology?

Yes 75% No 25% N/A 0%

Comments: A more extensive glossary is needed.

8. Does the guide provide trouble-shooting hints and strategies?

Yes 100% No 0% N/A 0%

Comments: The editing exercise was helpful.

9. Does the guide coordinate with the sample program disk?

Yes 100% No 0% N/A 0%

Comments:

10. Is the content of the guide accurate?

Yes 100% No 0% N/A 0%

Comments:

11. Are the procedures in the guide consistent?

Yes 100% No 0% N/A 0%

Comments:

12. Is the content of the guide appropriate for the user?

Yes 100% No 0% N/A 0%

Comments: The guide is good for a teacher to use to work with a class. A gifted student may be able to use it alone or with some directed instructions.

13. Is the writing style of the guide easy to understand?

Yes 100% No 0% N/A 0%

Comments:

14. Does the guide provide suggestions for modifications?

Yes 100% No 0% N/A 0%

Comments: There were adaptations for students at varying levels.

15. Can the user make these modifications easily?

Yes 100% No 0% N/A 0%

Comments:

16. Are the suggestions in the guide adaptable to different instructional strategies?

Yes 100% No 0% N/A 0%

Comments:

17. Are the suggestions in the guide compatible with classroom presentation?

Yes 100% No 0% N/A 0%

Comments:

18. Is the content of the guide relevant to the user's instructional needs?

Yes	100%	No	0%	N/A	0%
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Comments:

APPENDIX M

RECOMMENDATIONS FOR WORKSHOPS

The study guide and lesson plans included with the following recommendations were written for a 12 hour workshop using MECC's E-Z Logo and Apple Logo. The accompanying data disk includes various files that are used in conjunction with the lessons and the guide. The author of these materials adheres to the philosophy that Logo learning should be guided, not forced, and that an effective Logo environment encourages discovery-based learning. Adaptations made to meet the needs of the workshop participants will positively impact the participants' attitudes about Logo. Workshop facilitators who wish to use the study guide and lesson plans should consider the following conditions and factors which may affect the content and pacing of the lessons.

Computer Literacy

Participants with little or no computer literacy can be expected to complete approximately one-third to one-half of the material covered in the lesson plans and study guide. These participants require much structure

and guidance and seem to benefit the most when lessons and follow-up activities are monitored closely.

Prior Knowledge of Logo

Participants with prior knowledge of E-Z Logo or Apple Logo can be expected to complete most or all of the material covered in the lessons and the study guide. These participants require less structure and guidance and seem to benefit the most when they are given ample time to explore and experiment independently with the follow-up activities.

Mathematics Background

Although a strong mathematics background is not required to learn Logo, a general knowledge of geometry is helpful. Participants with a stronger mathematics background will grasp the concepts of the Total Turtle Trip Theorem, arcs and variables quickly. Participants with a weaker mathematics background may experience difficulty with turtle movements.

Learning Style

The ability to independently explore and experiment with the commands is influenced by the individual participant's learning style. While interaction and the sharing of ideas should be encouraged with all

participants, those participants who have prior knowledge of Logo or who are more computer literate seem to interact more extensively and require less assistance from the instructor.